# ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

JULY 1960

PRICE ONE DOLLAR

FOUNDED 1866

## THE CHANGING IRON ORE SCENE

Three major factors comprise the change and the challenge. Here's how Cleveland-Cliffs proposes to surmount them in its long-range planning. p 72

Pilot plant tests are well under way on semi-taconites, the next step in the Iron Ranges' move from direct shipping ore to taconites and beyond. p 73

Something new in screening.—From Malmberget, Sweden comes the story of an interesting screen design. p 88

## MAINTENANCE AND METHODS

International Nickel Co. of Canada opened the way for a new direct reduction process by beating cell corrosion with liners coated with epoxy resins. p 82

How to build your own rail straightener. Phelps-Dodge's inventive crew shows a simple, efficient way. p 86

## NEW AND IMPROVED MINING TOOLS

Union Carbide Nuclear made drastic reductions in survey calculation costs and time with a rented computer. p 77

The new Humphreys Sizer—an auxiliary device to the famous spiral, which can prevent coarse build up in front of the cleaner spirals in an iron ore circuit. p 84

Infrared spectrophotometry is becoming less expensive, more available for many analytical chores. p 92

## NEW FRONTIERS

Iran's untouched mineral wealth is awaiting foreign capital and a favorable investment climate may be developing. p 74

# TESTS like this one improve pumping of abrasives/corrosives

## DATA

Pump: B-frame Hydroseal Neoprene-lined

Slurry: Silica sand, 30-35% concentration by wt.

| Screen analysis: | | |
|---|---|---|
| | + 30 mesh | 1.0% |
| | + 40 mesh | 9.6% |
| | + 50 mesh | 28.5% |
| | + 80 mesh | 47.8% |
| | Pan | 13.1% |

Sp. Gr. = 2.65

Capacity: 350 GPM, 33 TPH, 800 TPD

Pump speed: 1150 RPM

## Which Elastomer?

At the Newport (N.J.) plant of Pennsylvania Pulverizing Co., Division of Pennsylvania Glass Sand Corporation, a B-frame Hydroseal Neoprene-lined pump is making history toward more efficient, more economical pumping of abrasives.

In moving silica-sand slurry, this pump was using an impeller made of Neoprene. By a change-over to an Adiprene Maximix No. 610 Impeller, the impeller life has been tripled! The first Adiprene impeller handled approximately 296.000 tons.

Just another addition to our fund of information that enables flexible A-S-H pumps meet baffling pumping conditions so successfully. May we help you?

**THE ALLEN-SHERMAN-HOFF PUMP CO.**
**Dept. B—P.O. Box 635, Paoli, Pa.**
*Representatives throughout the World*

# HYDROSEAL and CENTRISEAL
**SAND, SLURRY & DREDGE PUMPS**
MAXIMIX RUBBER PROTECTED

# NEW CRAWLMASTER DRILL

## packs more weight, power and versatility than any other machine in its class

AT A LARGE Southern Granite Quarry, this Gyro-Flo powered Crawlmaster demonstrated its super-slugging power by out-drilling two larger-bore machines in competitive performance tests. With its new super-power D-525 Drill and constant-pressure hydraulic feed and retraction, the Crawlmaster rated highest in both average and maximum penetration in all tests. Capable of percussion, rotary or Downhole drilling of 4″ to 6½″ holes in any position from vertical to horizontal, this 11-ton machine with dozer-type crawlers has the weight and stamina to handle the toughest drilling jobs. Features include all-hydraulic tower positioning, four 30″ stroke leveling jacks, remote-controlled reverse rotation and simple ejector-type dust collector.

An Ingersoll-Rand 900-cfm Gyro-Flo rotary compressor provides ample power for all drilling and moving functions. With other interchangeable drill combinations, a 600-cfm unit is ample. But whatever the size, Gyro-Flo's traditional dependability, smoothness of operation and exceptional freedom from maintenance make it the ideal Crawlmaster power supply. Low oil consumption, air temperatures under 200°F and closer regulation all the way from no load to full load contribute to lowest possible air power costs.

Ask your I-R distributor or engineer for complete information on the cost-cutting Crawlmaster Gyro-Flo combination.

**Ingersoll-Rand**

66A14 ♥ 11 Broadway, New York 4, N. Y.

*A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK.*

## *Mining Calendar*

American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D.C., Aug. 15-25

Eighth World Congress of the International Society for the Welfare of Cripples, New York, Aug. 28-Sept. 2

Sixth Annual Titanium Metallurgy conference, New York University (Heights campus), New York, Sept. 12-13

International Mining Congress, Hungarian Mining & Metallurgical Society, Budapest, Sept. 12-18

*National Mineral-Metallurgical Days, Association of Mining Engineers of Spain, Marques de Santa Cruz 14, Oviedo, Spain, Oct. 3-8

Rocky Mountain Minerals Conference, Salt Lake City, Utah, Oct. 5-7

"Third Quinquennial Alumni Reunion," Minnesota School of Mines & Metallurgy, (E. P. Pfleider, University of Minnesota, Minneapolis 14, Minn.), Oct. 7-8

American Mining Congress, annual meeting, Las Vegas, Nev., Oct. 10-13

Symposium on Surface Mining Practices, University of Arizona College of Mines, Tucson, Oct. 17-18

Tenth Annual Symposium on Production Drilling and Blasting, Colorado School of Mines (Prof. L. J. Parkinson) Golden, Colo., Oct. 17-19

Metallurgical Society, fall meeting, Sheraton Hotel, Philadelphia, Pa., Oct. 17-21

New Mexico Mining Association—Southwest International Mining Association annual meeting, La Fonda Hotel, Santa Fe, N.M., Nov. 3-5

Electric Furnace Conference, Morrison Hotel, Chicago, Ill., Nov. 30-Dec. 2

AIME annual meeting, Chase-Park Plaza Hotel, St. Louis, Mo., Feb. 19-23, 1961

*International Symposium on Agglomeration, Philadelphia, Pa., April 12-14, 1961

(*Note: Both the International Symposium and the National Mineral and Metallurgical meeting will employ the extremely successful technique used at the International Symposium on Mineral Dressing, held in London this year. The technique, which has been highly praised by visitors to the London meeting, involves supplying preprints of the papers to be presented to all pre-registrants well in advance of the meeting dates. At the meeting proper then, simple abstracts of the papers are offered by the authors and time at the symposia is left for questions and discussion.)

94th YEAR OF PUBLICATION

# ENGINEERING AND MINING JOURNAL

JULY 1960

A McGRAW-HILL PUBLICATION

*Volume 161, No. 7*

## *Departments*

6 Behind the Bylines
25 E&MJ Outlook
30 Markets
49 New Products Digest
100 Operating Ideas
108 Patents
96 Personals
26 This Month in Mining
28 Washington Impact

## *Articles*

71 Wanted—More Basic Information on Pumping Fluid-Solid Mixtures—An Editorial
71 Why Air Pollution Needs Continued Attention—An Editorial
72 The Changing Iron Ore Industry
73 Magnetic Roasting for Mesabi Semi-Taconites
74 Iran Seeks Mineral Development
77 Digital Computers Cut Survey Costs
82 Epoxy Resins Protect Concrete Tanks
84 Counterflow Sizer Benefits Spirals
86 An Efficient Rail Straightener Installation
88 New Vibrating Screen Improves Iron Ore Processing
91 Detergent Aids Blasthole Drilling
92 Infrared Analysis Is Quick and Easy

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*Continued on p 4*

# Rubber takes pounding that wears holes in steel

BIG chunks of ore—some weighing up to 2 tons—crash down from that vibrating feeder to a wear pad below. This terrific pounding 8 hours a day, 5 days a week, quickly wore holes in a wear pad of ½" thick steel plate, caused frequent shut-downs for repairs and replacement.

To avoid these costly delays, a B.F.Goodrich distributor suggested a wear pad made of a rubber called Armorite, specially compounded to stand this sort of a beating. This rubber is soft enough to *give* under the pounding it gets, yet so tough that it is even used in some places to carry broken glass.

The Armorite wear pad stood up under the pounding for 14 months —six times longer than the steel plate. And the Armorite wear pad pictured at left, which replaced the first when it finally wore out, is expected to last even longer because of a different method of installation.

B.F.Goodrich Armorite can be used in dozens of ways—as a liner, curtain, throw mat for protection against abrasives. Can be ordered with or without a reinforcing back of fabric, fiber or steel. Your B.F.Goodrich distributor has full information on Armorite. And, as a factory-trained specialist in rubber parts, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-863, Akron 18, Ohio.*

**B.F.Goodrich**

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# *Articles in this issue of*

# ENGINEERING AND MINING JOURNAL

*Continued from p 2*

72 **Three Challenges to the Iron Ore Industry**
Foreign competition, changing requirements for blast-furnace feed and the present oversupply of iron ore are three major problems confronting the iron ore industry. H. S. Harrison, executive vice president of Cleveland-Cliffs, evaluates them, and tells how his company proposes to meet these challenges in its long-range plans.

73 **New Life for the Mesabi—Semi-Taconites**
Declining production of direct-shipping iron ore will be offset in part in the future by production of iron-ore concentrates from non-magnetic, low-grade deposits called semi-taconites if current pilot-plant tests are successful.

74 **Iran—A Large Country with a Lot of Potential**
Favorable mining laws and a wide variety of minerals make Iran one of the potentially great mining countries. As yet, operators have barely scratched the surface, but there are signs that the mineral development is about to accelerate.

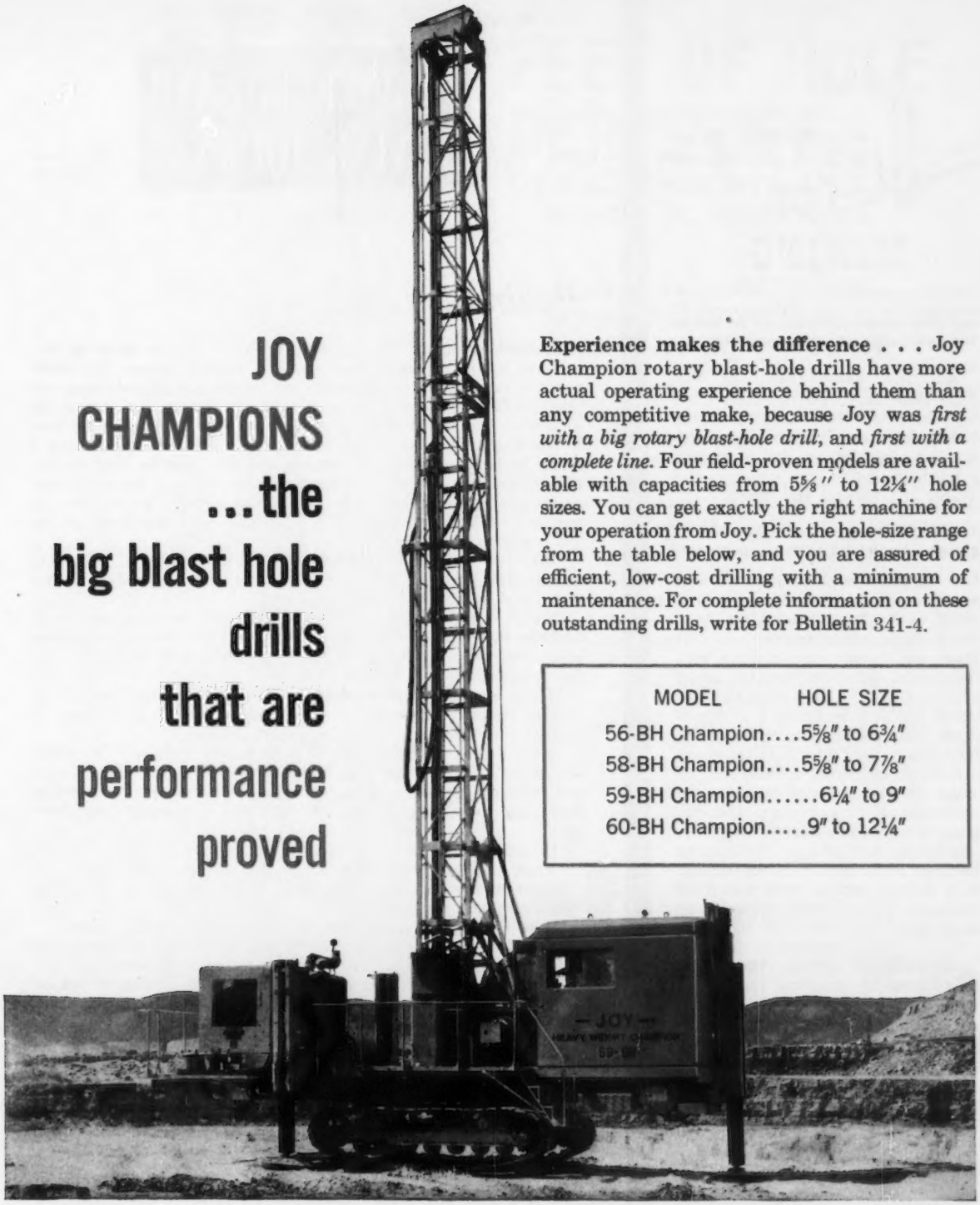
77 **The Digital Computer—A Proved Asset for Mines**
Digital computers have proved to be time savers and cost cutters in a number of industries. One of the most effective uses of these machines, however, is Union Carbide Co.'s application to mine survey computing. Union Carbide reduced their computing time by 99.993% and cut their traverse station computing costs by 86.4% at their Uravan operations. The full story, including how they did it, is presented in this article.

86 **How to Keep Your Track Straight**
Good straight track is a must for operators who want to keep their cars off the ground and their equipment moving. One way to have straight track is to build your own rail straightener. Enough information is included in this article for an operator to build an installation that has been tried and proved.

88 **Something New in Screening—Oversized Rod Slots**
Malmberget iron ore fines are screened more effectively with a new L-type screen developed and tested by this Swedish iron ore producer.

92 **Infrared's Uses in Analysis**
Two scientists from Kennecott Copper Corp.'s Salt Lake research center give examples of ways infrared spectrophotometry has simplified and shortened their analytical chores. Since instruments are becoming cheaper, many more mining companies may benefit from this technique than before.

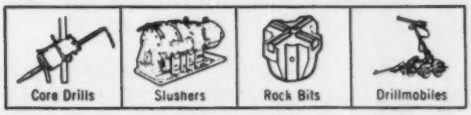
# JOY CHAMPIONS ...the big blast hole drills that are performance proved




**Experience makes the difference . . .** Joy Champion rotary blast-hole drills have more actual operating experience behind them than any competitive make, because Joy was *first with a big rotary blast-hole drill*, and *first with a complete line.* Four field-proven models are available with capacities from 5⅝" to 12¼" hole sizes. You can get exactly the right machine for your operation from Joy. Pick the hole-size range from the table below, and you are assured of efficient, low-cost drilling with a minimum of maintenance. For complete information on these outstanding drills, write for Bulletin 341-4.

| MODEL | HOLE SIZE |
|---|---|
| 56-BH Champion | 5⅝" to 6¾" |
| 58-BH Champion | 5⅝" to 7⅞" |
| 59-BH Champion | 6¼" to 9" |
| 60-BH Champion | 9" to 12¼" |

**EQUIPMENT FOR MINING... FOR ALL INDUSTRY**




**JOY**

**Joy Manufacturing Company**
**Oliver Building, Pittsburgh 22, Pa.**

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

# 94 YEARS OF MINING

**The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.**

**ARIZONA, APRIL 1866** — At Williams Fork the copper mines are turning out finely. The Colorado Steam Navigation Company's barge passed La Paz, going down the river with a full load of first class ore from the Planet and Mineral Hill mines.

**MARCH 1866 — GARDNER'S PATENTED ROCK DRILLING MACHINE.** One of these machines can be seen any hour of the day, drilling into a block of Rockport (Mass) granite—the hardest granite known . . . 300 blows per minute can be given with the utmost force the steel-drill point can bear. . . . The cross-head to which the drill is attached is drawn back; and thus compressing the spring by a cam rivetted directly to the piston rod of an oscillating cylinder (air or steam driven), the drill point has an automatic turning motion, and the entire machine an automatic feed, self-regulating, according to the varying hardness of the rock. . . Rock-drilling, it is claimed, can be done with these machines for one-tenth the cost of hand labor and one-tenth the time.

**MELBOURNE, APRIL 1866** — A quartz-crushing machine capable of working up 300 tons a week has been constructed which crushes and amalgamates in one operation. It is expected to do the work at about 54 c per ton, while the cost in a machine working 2,000 tons per week is calculated at 12 c per ton. The bed of clay beneath Philadelphia, which contains about 38 c worth of gold per ton, could be worked at these rates.

**PATENT CLAIMS**

53,444 — Process of Reducing Refractory Gold, Silver and Copper Ores.—Charles W. Harvey, Buffalo, N. Y.:

I claim the reduction of refractory gold, silver and copper ores, in common blast furnaces to the degree of obtaining pigs or bars of white metal therefrom, but combining and smelting therewith, either the carbonate of lime, soda, muriate of soda, or other alkali or slag, substantially as described.

*This month in*

**ENGINEERING AND MINING JOURNAL**

*Continued from p4*

## *Behind the By-Lines*

**An inflexible rule** in brainstorming says that if you set out to solve a problem by batting ideas around in a discussion session, you must never, never rule out a suggestion, no matter how ridiculous or impractical it may seem to be at first glance. By batting around the incredible, you may stumble upon the ingenious. So some of the boys in our shop decided to brainstorm new uses for lead after reading a report by Union Carbide that the fuel cell may soon be used in electric trucks, automobiles, switching engines, tractors, industrial materials-handling equipment, etc. This would certainly put a crimp in the uses of lead in tetraethyl and batteries—the backbone of the lead market.

"Why not use lead for flooring?" stormed the first brain. "A mining man in Salt Lake City used it in his foyer and everybody who has seen the floor raved about it."

"Sure," stormed brain 2, "If you sold lead flooring, you could advertise that you would buy it back for scrap value when the building is wrecked. What linoleum or cement manufacturer could give you that sales talk?"

"Think how easy the lead floor would be on the feet," popped up another stormer. "Department stores should go for lead floors to combat sales resistance of the foot-weary shopper."

"What if the lead floor creeps?" (Let's not be negative.) "No problem at all," fired the optimist, "the bright boys in the lead industry can certainly develop a roller, or a big flatiron to put that creepy floor right back where it was, or better still, develop a creep-proof alloy."

"How about colored alloys to snare the interior decorators?"

"Yeah, and think about shielding people against cosmic rays."

"Some of the lead producers ought to lay down a lead floor in their plants to try the idea out."

"What if you drag a load over the floor, won't you get gouges?"

"You don't drag things over floors, they've invented the wheel and besides, everything is lifted and handled with industrial trucks."

How about putting down a test stretch of lead flooring in one of the subway tunnels? We know a dandy one between the bus depot and Times Square, where even the concrete wears out.

"What about high heels?"

"They'd be good for lead floors, you'd see the stipple pattern . . ." (Sorry, the tape recorder didn't go out of commission, we just ran out of space.)

**News notes from all over:** "George White, Lovelock (Nev.) assayer, developed and operated what was probably the shortest-lived mine in Nevada history during February. Since 1948, White has tested iron ore brought to his office by Minerals Materials Co. trucks. Each truck had spilled a little ore in the parking area and in February, White ran a test on his own property. He then mined 700 tons of ore from the lot, sold it back to Mineral Materials, and closed his mine."

From the NYTIMES: "The National Science Academy has selected the type of man it considers best choice as the first voyager to the moon—a hard-rock geologist." Nominees, anyone?

From E&MJ in March: "United Keno Hill Mines Ltd. . . . in Alaska . . ." From a Canadian publication: United Keno Hill . . . the big Yukon mine is Canada's leading silver producer . . ." From William V. Smitheringale of Conwest Exploration Co. Ltd.: "Keep your sticky fingers off us." From E&MJ: Humblest apologies.

# 1500 FEET OF HOLE PER SHIFT*

## IN SEDIMENTARY AND ALLIED FORMATIONS

***... typical of the REICHdrill "750 Series" performance ... under difficult operating conditions.***

In metal or non-metallic mining, job performance records like this are standard with REICHdrills. These highly productive drilling units have built a reputation for keeping maintenance costs low ... footage records high. Why? Because:

... REICHdrill features include: fast, easy adjustment of rotary speeds and down-pressure for optimum penetration and bit life in all formations
... direct drive to drill stem that saves power loss
... no complicated transmission, no rotary table, no kelly means in and out of the hole faster
... instant safety torque release protects all drive components, saves rotary bits, core barrels and drill stem.

And these features help set performance records: masts incline for angle drilling; CP heavy-duty compressors meet all air demands; all controls are hydraulic ... operator relieved of "strong-arm" methods; CP "Air-Blast" Bits for extra footage in toughest formations.

*CT-750 Crawler-tractor mounted REICHdrill for blast hole drilling. Holes to 9 inch diam.; down-pressure to 45,000 lbs. Other REICHdrills, truck or crawler-mounted, for all open pit operations.*

*For further information write:*

**REICHdrill**

1442 BEECH STREET, TERRE HAUTE, INDIANA

Division: CHICAGO PNEUMATIC TOOL CO.

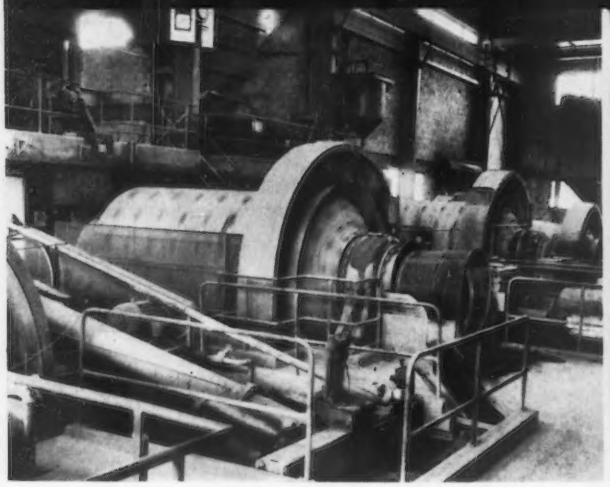
* Details on request

*Another example of*

# DORR-OLIVER PROJECT

*At The New Jersey Zinc Company's*

One of three Dorr 8' x 32' Reciprocating Rake Classifiers at The New Jersey Zinc Company's plant operates in conjunction with rod mills in grinding circuit.



Regrind circuit includes two 12' dia. Dorr Bowl Classifiers (one shown below) for separation of fine sands.

With its world-wide engineering experience in handling virtually all types of solids-liquids unit operations involved in wet chemical, metallurgical and industrial processing, Dorr-Oliver is able to offer a complete project engineering service covering all phases of plant design and construction.

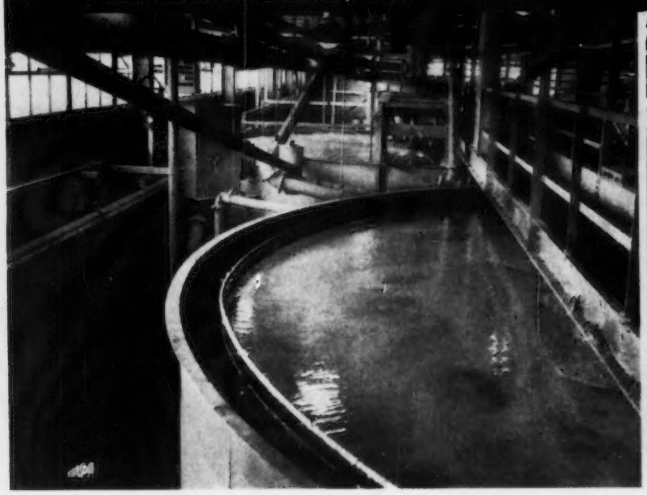
Recognition of the value of this service is offered in the increasing use of Dorr-Oliver project engineering by leading producer companies. One example is The New Jersey Zinc Company's 2500 TPD zinc flotation plant at Friedensville, Pennsylvania in which D-O played a major role in plant component design. In addition to engineering services, Dorr-Oliver also supplied rake classifiers in the grinding circuit, bowl-type classifiers in the regrind circuit, tray thickeners for middlings recovery, thickeners and a disc type vacuum filter in the final recovery circuit.

The scope of Dorr-Oliver engineering services is indicated at right. For specific information on how we can help on your particular project, write Dorr-Oliver Incorporated, Stamford, Connecticut.

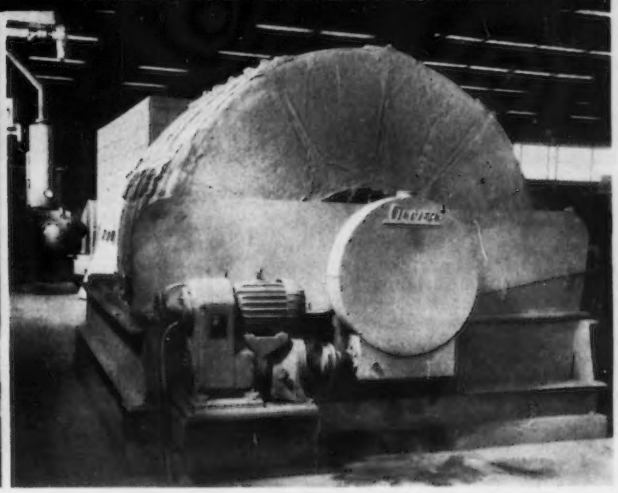
# ENGINEERING

## *2500 TPD flotation plant*

35' dia. Dorr Thickeners — 2 units installed — handle concentrates in final recovery ciruit.



8'6" dia. by 7-disc American® filter handles thickener underflow. Cake is conveyed to storage or smelter.



**HERE'S WHAT DORR-OLIVER PROJECT ENGINEERING INCLUDES:**

Laboratory Testing
Pilot Plant Demonstration
Flowsheet Preparation and Engineering Studies
Cost Estimates
Plant Design and Specifications
Purchase of Equipment
Erection and Construction
Supervision of Initial Operation
Training of Plant Personnel

**Booklet Gives Complete Details and Examples of Installations**

A newly published bulletin describes the scope and services offered by Dorr-Oliver Project Engineering, as well as typical plants that have been designed for companies in all parts of the world. Ask for Bulletin No. 8010.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

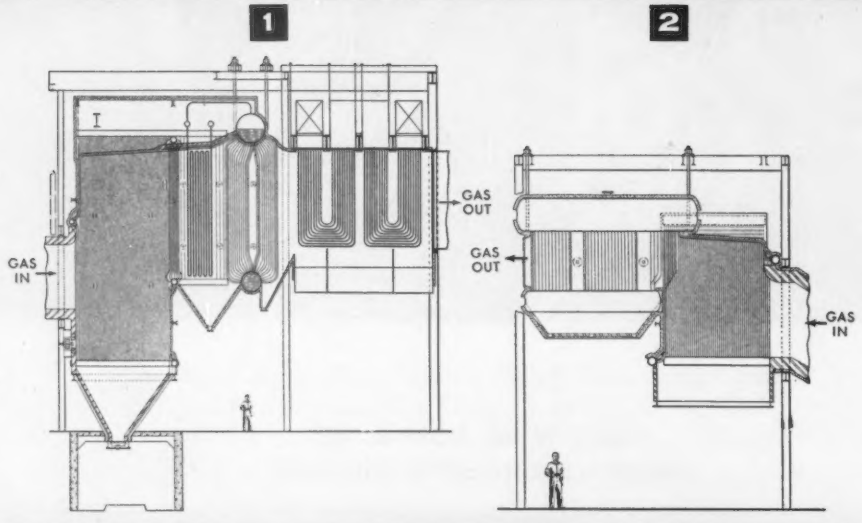
# Effective Utilization of Waste Heat in Metallurgical Processing

**CUSTOM-ENGINEERED B&W UNITS**

Illustrated are 5 B&W Heat-Recovery Units, typical of many currently serving the metallurgical process industries. Complete data on application and modification of these and other units will be found in B&W Bulletin G-88, previously mentioned. Please write for your copy today. Address: The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

**B&W WASTE HEAT RECOVERY UNITS FOR**

1. Copper Reverberatory Furnaces
2. Refining Furnaces for Copper and other metals
3. Ore Roaster, Acid Plant or Kiln
4. Zinc Fuming Furnaces
5. Heat Recovery with high temperature air heating and corrosion section




## CONSIDERATIONS

The economic success of many metallurgical processes requires recovery of valuable heat and entrained product particles in waste gases.

In selecting or designing the best boiler for this important task, the following factors must be considered:

- **Quantity of waste gas**
- **Gas temperature**
- **Gas pressure**
- **Chemical constituents of waste gas**
- **Concentration of metallics and ash in waste gas**
- **Size and abrasive characteristics of entrained material**
- **Fusion temperature of material carried in waste gas**

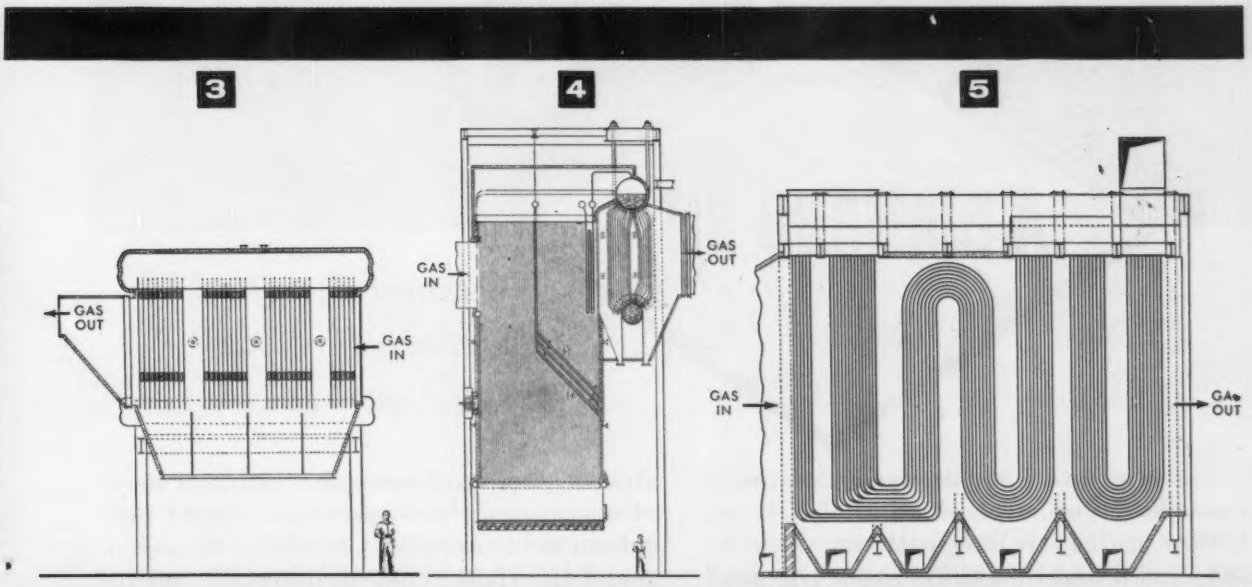
Specific operating requirements further complicate the problem of heat and product-particle recovery. For a complete discussion of Waste-Heat Boilers and their application, write for B&W Bulletin G-88.

# B&W DESIGN FEATURES

B&W heat-recovery and boiler-design specialists have years of practical experience in designing units for a wide variety of applications. Custom-engineered to meet specific process requirements, B&W Waste-Heat Boilers incorporate the following outstanding design features:

- Slagging problems are eliminated by cooling waste gases below the ash fusion temperature in water-cooled furnaces.
- Waste gas leakage and acid corrosion are eliminated by providing pressure casing. The casing temperature is maintained above the dew point of corrosive constituents in the gases. This inner casing permits operating up to seven inches w.g. gas pressure.
- Tube erosion by gas-borne material is eliminated and low-draft losses are obtained by designing for low-gas velocities, with no gas baffles in the tube bank.
- In-line tube arrangements used throughout permit efficient tube bank cleaning by soot blowers, or hand lancing when appropriate.
- High-efficiency B&W Cyclone Steam Separators prevent solids carry-over in the steam, thus protect against superheater and turbine fouling difficulties.
- Complete visual observation of all heating surfaces is provided with ample, properly located doors and lance ports.
- Hoppers wth steep sloping sides and large outlet connections prevent material "hang-up."

These built-in features assure continuous, trouble-free operation with low maintenance and high efficiency from every B&W Waste-Heat Boiler.




B&W Bulletin G-88
— "Effective Utilization of Waste Heat"
— on request.

ME-101

B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

# A DIAMOND BIT...

*Custom designed by Christensen for your drilling requirements*

Whatever your drilling needs—underground or on the surface, exploration or blast holes, shallow or deep drilling with air, water or mud—you'll find that Christensen Diamond Bits are your assurance of drilling at "less cost per foot."

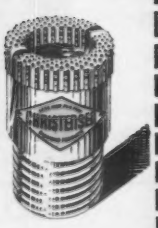
Christensen Diamond Bits cut straighter holes, last longer and cut even the hardest rock economically.

And, regardless of your job location or scope of operations, there's an experienced Christensen field consultant available to recommend the right "custom designed" bit for your job. This means that you can be confident that the diamond size and pattern, waterways, matrix hardness and bit style correctly meet your drilling conditions.

*"Less cost per foot."*

**CHRISTENSEN DIAMOND PRODUCTS**

MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
P. O. BOX 387 SALT LAKE CITY, UTAH



To obtain faster penetration, straighter holes, better diamond usage, unequalled service and experienced consultation, contact Christensen.

On a job like this, moving rock is not a matter of hours—it's a matter of days—weeks—months! It's not a matter of the cost of moving the tonnage of today's loading. What will be the cost per ton over the next six months—or year?

We have said before, shovel output is not measured by the speed of the hoist or the swings per minute. Production and profit is the result of constant day-in, day-out, month after month operation.

Your Northwest is a *real* Rock Shovel, a proved Rock Shovel. The Northwest Dual Independent Crowd handles harder digging and more yards per hour. The big Uniform Pressure Swing Clutches, assure spotting, a real time saver. From its heavy duty Cast Alloy Steel Bases to the ample power of its engines, its ease of control, its smooth mobility, every advantage combines to assure, not just output for the day, but continuous output. These are the things that get the job done—the things that make it possible for you to say, "That Northwest is always ready to go!" They are among the features that make the Northwest the finest machine of its kind.

***DETAILS MAKE EQUIPMENT! DIG INTO THEM. A NORTHWEST MAN CAN HELP YOU.***

NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

S-30-4-1

# For a better profit picture...

# CHECK EUCLID C-6 WORK-ABILITY

You'll find this new C-6 has the all-around tractor versatility needed for heavy construction, mine and quarry work. With five years of rugged field and proving ground test, this new crawler sets higher standards of performance on the toughest jobs for tractors in the 200 h.p. class.

Here are just a few advantages you get in the C-6 . . . a dependable GM 6-71 engine delivering 211 net h.p. to the power train . . . a proven Torqmatic Drive that provides full-power shift and cuts cycle time . . . fast-as-a-fox maneuverability . . . almost unbelieveable ease of handling . . . accessibility for servicing that pays off in more productive time on the job. It responds like nothing you've ever touched!

Have your Euclid dealer give you all the facts on the C-6 . . . he'll show you why this new "Euc" belongs in your spread . . . why it's your best equipment investment.

**EUCLID** Division of General Motors • Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

## EUCLID EQUIPMENT

*FOR MOVING EARTH, ROCK, COAL AND ORE*

*You never had 'em so tough!*

# HARD ROCK LUG XTRA TRED

Here it is! From Goodyear's advanced technology and processes—

HARD ROCK LUG XTRA TRED—the mine and quarry tire that's built with extra tread to take it where the going's tough!

It's made with 3-T Nylon Cord—triple-tempered by Tension, Temperature and Time—that makes *the world's toughest tire bodies.*

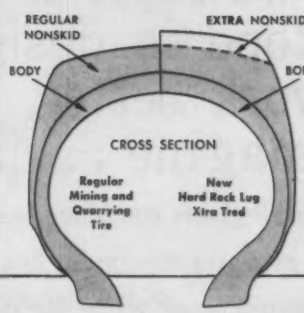
It has specially compounded rubber that embodies remarkable super-toughening agents for far greater chip-, wear- and penetration-resistance—that produces *the world's toughest treads.*

And, with its thicker nonskid tread depth (as much as 71% thicker) for harder-biting, longer-wearing lugs, you take out *more pay loads in less time and at lower cost*—with fewer maintenance headaches, too!

Ask your Goodyear dealer about Hard Rock Lug Xtra Treds, *now.*

Goodyear, Truck Tire Department, Akron 16, Ohio.

**MORE AND TOUGHER RUBBER IN THE RIGHT PLACES!**




**THE WORLD'S TOUGHEST TRUCK TIRES BY**

# GOODYEAR

Xtra Tred—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

**MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND**

HEAVIER OUTSIDE WIRES mean great resistance to abrasion. FINER INSIDE WIRES mean excellent drum winding characteristics.

In REGULAR LAY ropes the wires are laid in a direction opposite to the lay of the strands. This provides stability even under severe operating conditions.

In LANG LAY ropes the wires and strands are laid in the same direction, providing exceptional flexibility and abrasion resistance.

# Two ropes in one! Roebling Herringbone® Wire Rope is designed and made to wear better, work better, last longer than you can possibly imagine . . . unless you've tried it yourself!

Herringbone combines two pairs of Lang Lay strands with one pair of regular lay strands to give you maximum flexibility, good stability, mighty strength. Call your Roebling Distributor — or write for details to Roebling's Wire Rope Division, Trenton 2, N. J.

HERRINGBONE
WIRE ROPE

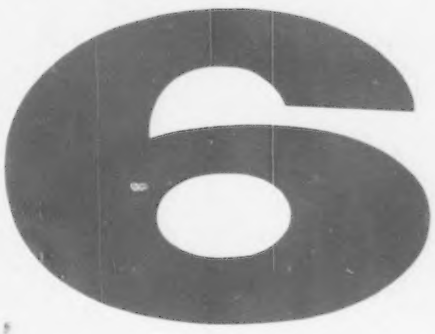
**ROEBLING**

*Branch Offices in Principal Cities*
*John A. Roebling's Sons Division*
*The Colorado Fuel and Iron Corporation*

# It's a fact...

ALLIS-CHALMERS
TRACTOR
LOADERS

# give you




# big bonus features...

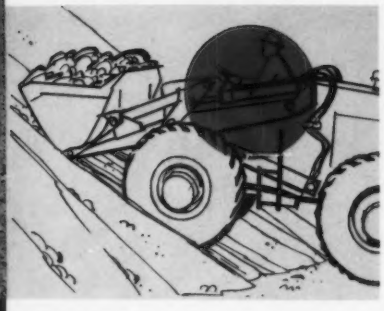
ALLIS-CHALMERS




ALLIS-CHALMERS

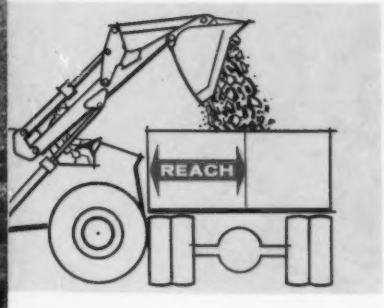
# ONLY THE TL 14 TL 16 TL 20

## safe dump cylinder location



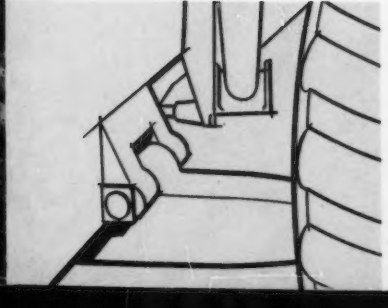
One "common sense" advantage that pays off is the safe dump cylinder location. The TL-14, 16 and 20 have cylinders located up and away from abrasives . . . out of grit that scores piston rods and damages hydraulic components. By mounting cylinders away from the bucket Allis-Chalmers loaders lift more pay load . . . less dead weight.

## extra lift and reach




The "Big Three" give you more *usable dumping height and forward reach* than units of comparable size. Because Allis-Chalmers measures loader reach from tires, you are assured of *effective reach* . . . reach that pays off when loading high-body trucks. The TL-20, for example, gives you a foot or two of *extra reach* for faster loading with less chance of damage to truck or loader.

## pin-connected axles

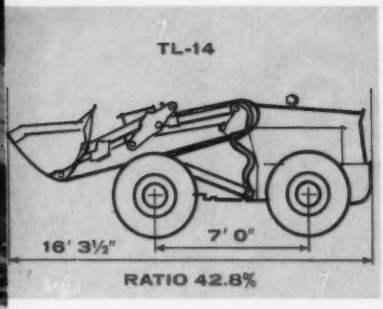


Axles on Allis-Chalmers "Big Three" loaders are pin-connected directly to the frame with 2-inch diameter steel pins . . . not automotive-type, U-bolt connections. In rough going, these units stay solid . . . axles do not roll or shift under load.

OFFER ALL OF THES

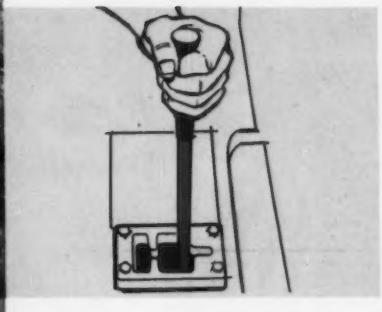
# SE PROVED ADVANTAGES

## unmatched stability



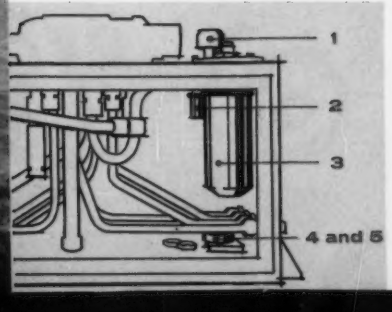

All three models offer higher wheelbase to length ratio for added overall stability. The kind of stability that lets you carry big loads at higher speeds over rough terrain . . . without tipping or spilling the load. Operators work with confidence on tricky loading operations, slope and stockpile work.

## full control right in your fist

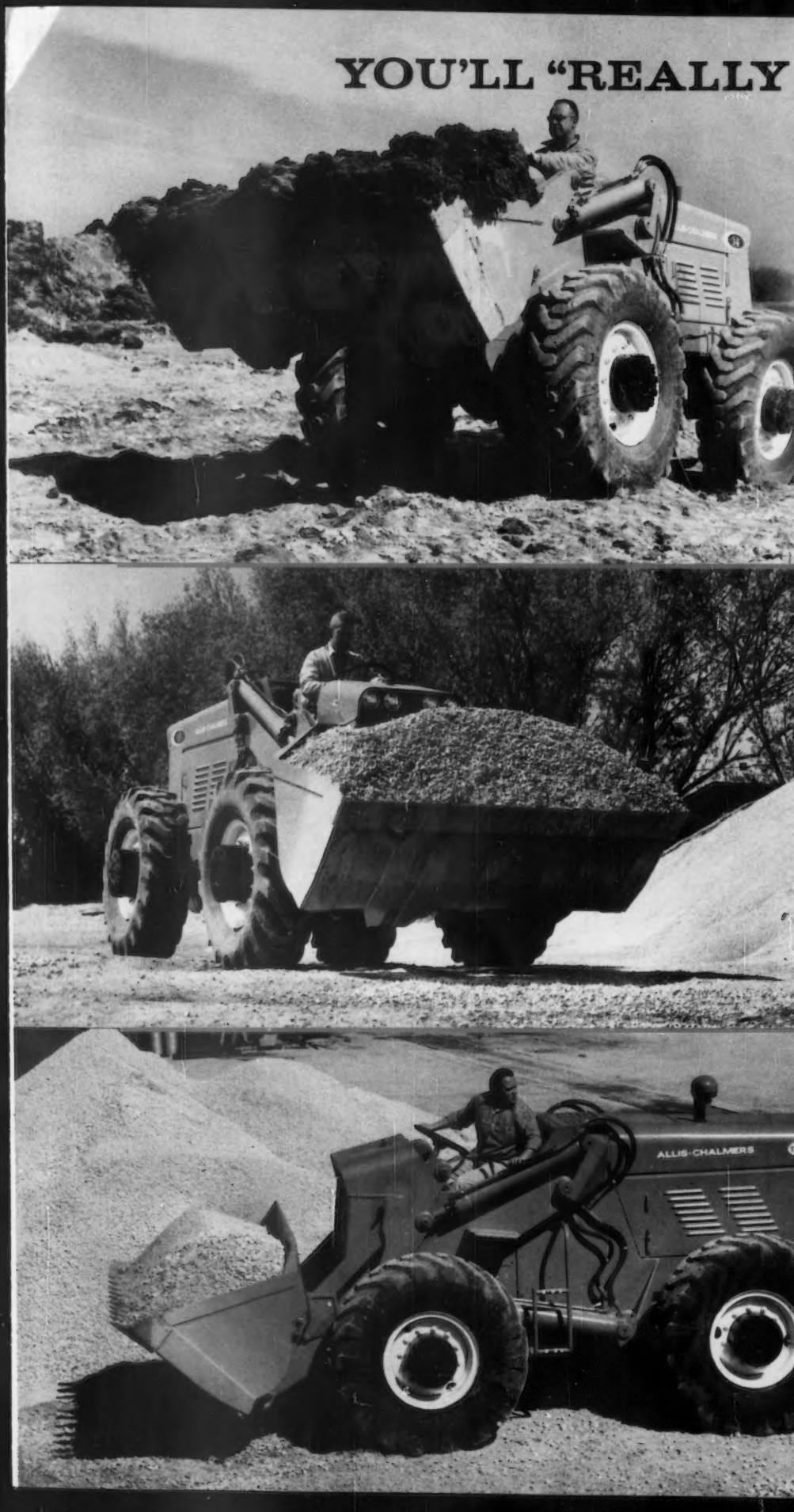


Exclusive single-lever control lets you go into and out of any speed, forward or reverse, with just a quick swish of your hand. Allis-Chalmers "one-stick" control makes fast work far easier by taking the time loss out of gear selection. Operators keep working at full capacity all day long.

## 5-way hydraulic filtering protection




Only Allis-Chalmers tractor loaders provide 5-way protection for the hydraulic system. Air is double filtered by: *1. air breather* *2. air filter.* Hydraulic oil is cleaned by: *3. full-flow micronic filter* *4. conical screen,* and *5. magnetic filter.* Complete filtering protection means peak operating efficiency . . . extended life. Filters are easily accessible for cleaning and replacement.


YOU'LL "REALLY
ALLIS-CHALMERS

# Y GO" WITH THE "BIG THREE"

## 5,300-lb carry capacity . . . 1 to 3-cu-yd buckets

TL 14

*For all-out savings*, the TL-14 with *Tractomatic* transmission is the machine for you. On short-haul loading or stockpiling your operator selects the best working gear. By flipping a lever on the steering column, he goes forward or reverse without shifting gears. *For all-out production* on long hauls or scattered jobs, the TL-14 with full-power shift transmission fits the bill. Operators move from any one speed to any other . . . forward or reverse . . . on the go.

## 7,000-lb carry capacity . . . 1½ to 4-cu-yd buckets

TL 16

The TL-16 is big enough for real production work . . . yet compact enough for hit-and-run assignments. It features the same design, construction and operating advantages found in the bigger TL-20. This unit handles the same kind of work as the TL-20, but on smaller scale operations. On all jobs, you can count on the "16" for fast, efficient service day in, day out.

## 9,000-lb carry capacity . . . 2¼ to 5-cu-yd buckets

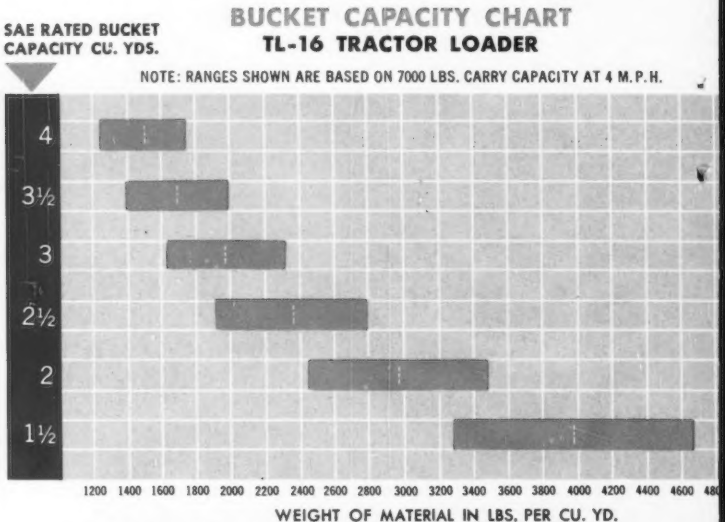
TL 20

The 130-hp TL-20 is built for big, tough excavating and loading on construction, mining, quarrying or public works projects. Its many bonus features let you get more work done . . . easier. For example, the extra reach you get lets the TL-20 load big trucks faster and higher than other machines of comparable size.

# YOU choose the bucket best suited to your needs...

Allis-Chalmers offers 18 buckets for these 3 models. The TL-14, TL-16 and TL-20 all provide 6 different bucket choices. You pick the best bucket size according to the *carrying capacity of the loader*, the *weight of material you handle*, and the *working conditions in which you operate.* Your Allis-Chalmers dealer will help you select the best profit-making tractor-bucket combination.

This TL-16 bucket chart shows how bucket sizes can be determined:


SAE RATED BUCKET CAPACITY CU. YDS.
BUCKET CAPACITY CHART
TL-16 TRACTOR LOADER
NOTE: RANGES SHOWN ARE BASED ON 7000 LBS. CARRY CAPACITY AT 4 M.P.H.
4
3½
3
2½
2
1½
1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400 3600 3800 4000 4200 4400 4600
WEIGHT OF MATERIAL IN LBS. PER CU. YD.

TO SELECT CORRECT BUCKET CAPACITY FOR ANY OPERATION YOU MUST KNOW; 1, THE WEIGHT OF MATERIALS TO BE HANDLED AND 2, THE CONDITION OF THE OPERATING SURFACES.

Your Allis-Chalmers dealer will put a tractor loader through its paces on your job. Take a good look at all of the features that make these loaders the best buys on the market. Let him set up a demonstration now. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

**move ahead with**

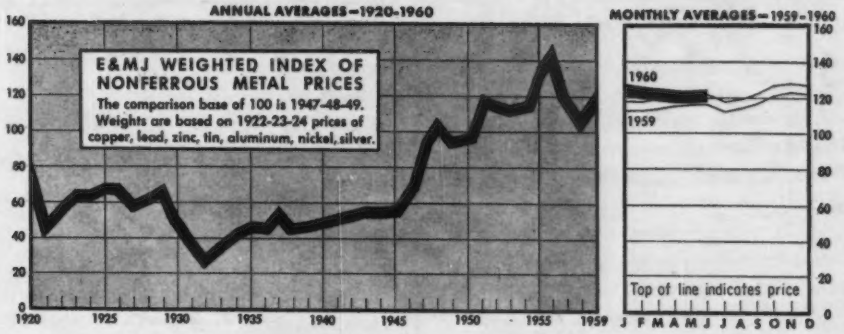
**ALLIS-CHALMERS**

**...power for a growing world**

Printed in U.S.A.

# E&MJ OUTLOOK

## PRICES




## MARKETS

**For the third consecutive month** E&MJ's nonferrous metals price index has been virtually unchanged—125.9 for June, 125.8 for May, and 125.8 for April.

**The close of June marked** the 16th consecutive week during which copper was priced at 33c per lb for domestic delivery—a record in postwar stability.

•

## AT HOME

**Steel forecasters admit** that estimates for production during the first half of 1960 were too high, but expect ingot output for 1960 to total 115- to 118-million tons, possibly topping the 1955 record total of 117-million tons. The automotive industry expects production to total 6.5-million cars for 1960.

**Cleveland-Cliffs Iron Co.** plans to increase capacity of the Republic Mine in Michigan from 700,000 tons of iron ore concentrate to 1.6-million tpy. Half of the product will average 64½% iron content and will be processed in new facilities at the Republic plant, the balance, averaging 62% iron will be pelletized by the Eagle Mills pelletizing plant.

**Commonwealth Engineering Co.** has patented a blast furnace process by which fuel consisting of powdered metal, coal dust, a metal stearate, hydrogen and oxygen will be introduced through the tuyeres. Temperatures of 4,000 to 6,000° F will permit the direct smelting of ores of aluminum, titanium and other refractory materials.

•

## LABOR

**The Supreme Court has agreed** to take the Maurice Travis case. As a result of this decision, United Mine Mill & Smelter Workers hope that cases involving other members of union will also be reviewed.

•

## ABROAD

**Hanna Mining Co.'s** plan to develop its huge iron ore deposit in Brazil ran into opposition by government officials at the outset of negotiations, but it is expected that Brazilian authorities will approve the plan after further study.

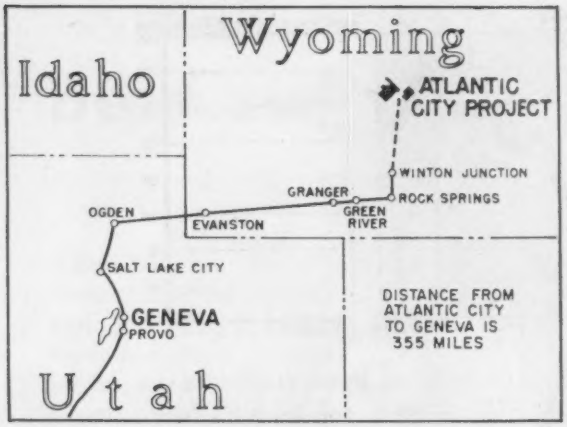
**Canadian scientists may** be on the brink of a major outlet for uranium if pilot-plant tests to produce a uranium-steel alloy are successful. The addition of one-half to four pounds of uranium to steel is said to increase fatigue resistance by 30% and improve corrosion resistance substantially.

**Japanese industry** is seeking Alaska's rich mineral resources. Fuji Steel Co. is trying to develop iron mines in the new state.

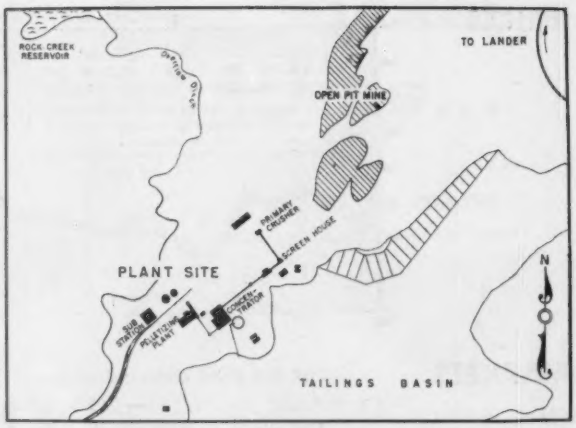
**Molybdenum Corp. and Wah Chang Corp.** will start construction of a mill in Brazil to produce columbium concentrate. Completion of the plant is scheduled for mid-1961.

**Union of South Africa** is building a plant which will produce about 100 tpy of uranium from uranium oxide.

# THIS MONTH IN MINING




**ABOUT 4,000 TPD OF PELLETS** will be shipped by rail via a 76-mile spur to the Union Pacific junction at Winton Junction for the trip to USS' Geneva works at Provo, Utah.




**NEWEST IRON ORE PRODUCER** in the U.S., and the highest—some 8,300 ft above sea level—is the new U.S. Steel mine, sketched as it will be when production starts in 1962.

## U.S. Steel Starts Atlantic City Pellet Project

Columbia-Geneva Div. of U.S. Steel will shortly begin construction of a $50-million iron ore mining and beneficiation facility 26 miles south of Lander, Wyo. The operation will supply pelletized iron ore to Columbia-Geneva's integrated steel plant at Geneva Works, near Provo, Utah, after 1962. Ore will supplement present sources from iron mines near Cedar City, Utah, which will remain in operation.

Known as the "Atlantic City Project," it will be the highest large-scale open pit mining operation in the U. S. Altitude is 8,300 ft.

Besides open pit mining operations, major units slated for construction include crushing and screening facilities, an ore concentrating plant, a pelletizing plant, and extensive water storage and handling system, and loading and shipping facilities.

Conventional open pit methods will be used to mine the ore, which contains about 30% Fe. Crushed ore will be magnetically concentrated to more than 60% Fe.

Pelletized ore will be shipped from Atlantic City via a new railroad spur to the UP line at Winton Junction, thence to Provo.

Stanley H. Cohlmeyer will direct the design and construction of the Wyoming operation.

Start up of project in Fremont Co. was signaled June 1 by J. D. McCall, president of the U. S. Steel division.

Once the Wyoming operations begin late in 1962, the magnetic taconite iron ore will be open pit mined to form a bowl-shaped pit having a slope of about 45°. Present plans call for the ore to be mined on 25-ft levels, with a 37½ ft shelf left every third level to stabilize the slopes. Haulage will be by truck. Mined ore will be crushed in three successive stages to minus ¾ in. and ground in rod mills to minus ¼ in.

The rod mill pulp will flow to magnetic separator tanks with the non-magnetic portion of the rock to waste.

The magnetic portion will be further reduced in size by grinding with steel balls until it is as fine as face powder. Two more magnetic treatments and a water washing operation will drop out most of the balance of the impurities.

A key unit of the water recovery system will be a tailings pond, expected ultimately to cover some 700 acres at a maximum depth of 170 feet.

Other units slated for construction at Atlantic City include an integrated, state-approved sewage treatment and disposal system, general and mine office buildings, a general shops building to house the various maintenance units and mine garage, warehouse, testing laboratory and other auxiliary facilities, including a dispensary and fire and ambulance station located in the lower level of the general office building.

To handle the Atlantic City pellets, some modifications or additions will be made to the iron ore storage and conveying facilities at Geneva Works, McCall added.

In another announcement, made later last month, U. S. Steel also noted that its long standing dispute with Kaiser Steel Corp. concerning iron ore claims near Eagle Mountain has been settled.

The announcement states that "Terms of the agreement provide for future development of the area to be undertaken either jointly by both companies or independently by either company under a royalty formula with the non-participating company. Both U. S. Steel and Kaiser Steel emphasize, however, that there are no plans for immediate development."

## East Tintic Plans 500-ft Development Winze

BEAR CREEK MINING CO. will let a contract in the next several weeks for the sinking of a 500-ft development winze from the 1050-ft level of the East Tintic project.

Sinking of the winze, some 1,000 ft west of the Burgin shaft is part of the development which is itself related to location of a production shaft on the lead-silver-zinc property.

The winze will have a vertical depth of 250 ft and will be sunk at a 30° angle off the 1050-ft, main exploration level in the district, according to present plans.

The 1050-ft level is only a relatively few feet above the district's water level. The winze also will evaluate water and temperature conditions in the new area.

It will test ore conditions previously outlined in core drilling in this area downward from the 1050 level.

Ray Gilbert, Rocky Mountain division geologist for the Kennecott affiliate, said that the winze would assist Bear Creek in evaluating main production shaft location. A second major shaft would be required in bringing Bear Creek's discoveries of the last several years into production.

Gilbert said that it is contemplated the winze will be of "standard size," possibly 8x8. It will be sunk utilizing standard drift mucking machinery, according to present plans. The work will be contracted out.

Completion of the winze and necessary evaluation work has raised a possibility that KCC may start mining the Tintic orebody by 1961.

## Beryllium Excitement Moves to Topaz Mt. Area

MAJOR COMPANIES are engaged in a beryllium rush in the Topaz Mt. area about 50 miles northwest of Delta in western Utah.

Dr. Norman Williams, vice president and chief geologist for Beryllium Resources Inc., said the scramble "has all the earmarks of the early days of the uranium race."

Also participating in the rush either in claim acquisition or investigation are exploration parties of E. I. du Pont de Nemours & Co., Wilmington, Del.; Food Machinery and Chemical Corp.'s mineral division, Pocatello, Idaho; Combined Metals Reduction Co., Salt Lake City; Vitro Chemical Co., affiliate, Vitro Corp. of America.

Dr. Williams said that Beryllium Resources Inc., a joint affiliate of Hidden Splendor Mining Co. and Federal Resources Corp., both of Salt Lake City, had obtained "around three claims."

R. C. Cole, vice president of Vitro, Salt Lake City, said his firm had obtained some ten claims. The existence of beryllium minerals in the Topaz Mt. area has been known since 1937 when a prospector named Nielson of Delta sent in a sample of fluorspar ore to U.S. Bureau of Mines station at Salt Lake City for analysis. The ore was found to contain beryllium. However, there was little or no interest in beryllium at that time.

What has attracted the prospectors and the major companies is the fact that the beryllium appears to be a surface deposit. Mineralogy is complex. Cole said at least one new beryllium mineral has been identified. His geologists already have called it "Vitrolyte."

A USBM spokesman said that some of the beryllium ores appear to be concentrated in the area as a part of a weathering process. Some values are even found in bentonitic-type clays.

The deposit doesn't appear to be huge by standards of more common metals.

Claim acquisition is proving complicated because the area has been a scene over the years of previous locations for fluorspar and uranium.

## Peru Copper Mine Bought By Japan Mining Co.

THE JAPAN MINING CO. signed contracts to buy a copper mine at Chapi, Peru, for about $1-million. The Japanese firm will establish a $3.5-million subsidiary in Peru to develop the mine. Development plans call for digging and processing 10,000 tons of ore monthly.

*(News continues on p 110)*

# *As We Went to Press . . .*

**Beryllium** (see left) dominated mining news towards the end of last month, with the highlights occurring in the Topaz Mountain area of Utah and in Mexico, where Beryllium Resources Inc. agreed to explore for, develop, mine and concentrate beryl for the Mexican AEC.

An announcement by Vitro Minerals, discussing the Topaz Mountain deposit, noted that the firm is one of the larger claim holders in the area and described the disseminated deposit as capable of being easily mined from the surface. Even more important, the Vitro announcement said studies of the ore "indicate (that it) is readily soluble in sulphuric acid." Vitro processes 660 tpd of uranium ore via acid leach at its Salt Lake plant at the present time.

In the Mexican announcement, Beryllium Resources has the specific right to mine and mill beryl for, and under the jurisdiction of, the Mexican AEC. Beryl is one of the three nationalized minerals which are assigned to AEC domain. When the Odlum-controlled mining firm has established reserves, another agreement with Brush Beryllium Co. will provide for construction of a concentrate plant. The Beryllium Resources contract is on a cost-plus basis.

**Spokane National Mines** started gold production from the property at Bannack, Mont., early this month. The firm has rehabilitated the old Bannack cyanamide mill and now has a production capacity of 80- to 100 tpd of ore.

**A contract for a 3,600-ft spiral incline** at the bottom of Bingham Canyon has been let by Kennecott's Utah Div. to Morrison Knudsen. The incline will speed connection with the haulage tunnel driven into the orebody (E&MJ, April 1959, p 134). The ore, according to Kennecott, will be ripped for the most part, and little blasting will be required (October 1958, p 93). The spiral will have a vertical depth of about 150 ft and a 4% grade. Ore trains, once the tunnel connection is made, will haul down the spiral and out the tunnel. Ore removed in excavating the spiral will be hauled in carry-alls to the present track level in the pit and reloaded into ore cars.

**Uranium producers** in Canada and Wyoming are joining the "together-we-stand" philosophy shown by Rio Tinto mines in Blind River. Hidden Spendor, Federal Resources and Gas Hills Uranium control about 1,500 claims in the Shirley Basin and have asked AEC for a license for a mill. Capacity of the mill was estimated at 800- to 1,000 tpd. The operators noted that they are studying "mining methods with equipment not used before in uranium."

Proposed amalgamation of Stanleigh Uranium Mining Corp. and Preston East Dome into Preston Mines Ltd. is another move in Blind River to move production contracts to lower cost properties. Under the agreement, Stanleigh will close and a portion of its allotted poundage would be delivered by Rio Algom Mines Ltd. and the remainder subcontracted to Preston Mines by Rio Algom.

**Foote Mineral Co.** has authorized construction of a 10,000-tpy electrolytic manganese plant at New Johnsonville, Tenn.

The plant, according to Gordon H. Chambers, president of Foote, will be built in two stages of 5,000 tons capacity each. The first unit is due in late 1961 or early 1962.

# WASHINGTON IMPACT

## Highlights

**THE PLUSSES** — Despite the fact that the 86th Congress fell far short of enacting the broad Government support legislation sought by domestic mining industries, it gave solid encouragement to two industrial groups that encompass more than metal-mineral producers before it recessed late in the month to return Aug. 8.

Domestic seekers of additional import restrictions on foreign competition won an unexpected victory in the comparative ease with which Sen. Robert Kerr (D-Okla.) put together a Congressional "log-roll" to force a showdown on the controversial issue of higher lead-zinc import tariffs (see story this page).

Economically distressed producers got substantial help in their running campaign for Government subsidies in the form of legislation to prop domestic prices of small lead-zinc mine operators.

As this issue of E&MJ went to press, it was still uncertain whether either higher lead-zinc tariffs or small mine price subsidies would be voted by Congress and signed by the President. But the fact that both moves came as close to final approval as they did in the closing days of the legislative session indicated that these and similar proposals at least were kept alive for the new Congress convening next January.

The Kerr lead-zinc tariff proposals, backed by domestic smelters, were less restrictive than those provided in the measure introduced by Rep. Howard Baker (R-Tenn.), backed by the industry's Emergency Lead-Zinc Committee.

The Kerr rates would raise the import tax on lead ores and concentrates from 0.75c per lb to 1.4c, on lead metal from 1.0625c to 1.05c, and on zinc metal from 0.7c penalty duty would be added to imported ores, and a 1c penalty to metal, when domestic lead prices dropped below 13½c, zinc below 12½c, and remain in effect until the domestic price of each went up 1c.

By a complex legislative maneuver (see right), Kerr tied into this measure an import quota on foreign shrimp to win the support of free-trading Rep. Hale Boggs (D-La.) on the House Ways & Means Committee, substitute his bill for the Baker bill, and ease the package through both houses of Congress.

Kerr also was the prime mover behind the measure he and Rep. Ed Edmondson (D-Okla.) introduced to support domestic lead prices at 17c, zinc at 14½c on the output of mines producing up to 2,000 tpy of each metal. The measure was "voted out" by the Senate Interior Committee just before the recess was called.

**MINUSES**—Other proposals aimed at supporting domestic metal-mineral industries did not come as close to final enactment as did the intricate Kerr maneuver.

At press-time, Senate Mining Bloc efforts to broaden a House measure to provide incentive purchase bonuses to small domestic producers of beryl, chromite, and columbium-tantalum—to cover numerous other minerals—loomed as a major obstacle to its passage.

A Senate bill to center mining policy administration responsibility under the Secretary of Interior bogged down in the House. Numerous other import restriction legislation, incentive purchase bills, and subsidy measures appeared headed for failure.

On the administrative side, U.S. trade policy officials are standing firm in their intention to offer trade concessions on some 58% of domestic metal-mineral imports at international tariff negotiations under the General Agreement on Tariffs & Trade at Geneva, Switzerland, next fall.

Hearings before the Tariff Commission and the inter-agency Committee on Reciprocity Information got underway this month, at which domestic business affected by the proposed tariff reductions have their day in court to protest inclusion of their products on the so-called "offer-lists."

Among the mineral imports on which the Administration hopes to bargain lower duties in exchange for foreign concessions to U.S. exports are the following: antimony oxide, barium carbonate, cobalt oxide, magnesium compounds and salts, manganese ore, compounds and salts, mica, vanadium, molybdenum ore, concentrates and alloys, tungsten alloys, metallic magnesium alloys and scrap, and nickel and alloys.

## Kerr Builds a Duty Bill; There's Hope for 1961

THE LEGISLATIVE tariff maneuvers of Sen. Robert F. Kerr, (D-Okla.) in behalf of higher duties on imported lead and zinc stole the show for domestic metal-mineral interests on Capitol Hill as the month-long recess of the 86th Congress approached.

As this issue of E&MJ went to press, enactment of Kerr's proposed new rates on lead-zinc imports by both Senate and House remained a last-minute question mark and a White House veto loomed likely.

But aside from the immediate success or failure of Kerr's tactic, the veteran Senator proved an even more significant point to a broad range of domestic interests seeking additional import protection from foreign competition. That is, that it now appears politically possible to put together a Congressional "log-roll" which could result in Congress legislating higher tariffs on any number of items when it convenes again next year.

Not since the basic Reciprocal Trade Agreements Law was first passed in 1934 has Congress directly legislated any tariff increases. More important, Congress has particularly steered clear of even considering import restrictions on items turned down for additional protection by the Tariff Commission—as in the case of lead-zinc and shrimp, the two items Kerr centered his deal around.

Another facet of the Kerr maneuver is that it has worked out initially without the participation, or even the knowledge, of many of the key Senators and Congressmen who make up the so-called Mining Bloc on Capitol Hill: men like Senate and House Interior Committee chairmen James Murray (D-Mont.) and Wayne Aspinall (D-Colo.), Senators Mike Mansfield (D-Mont.), Henry Dworshak (R-Idaho), Gordon Allott (R-Colo.), and Rep. Walter Rogers (D-Tex.).

**Here is how the Kerr plan was set to work:**

Faced with an inter-industry split over what additional protection should be sought, Kerr simultaneously backed the efforts of two of three lead-zinc factions. For the small mine operators, Kerr—together with Rep. Ed Edmondson (D-Okla.)—barely won House passage (197-191) of their bill to provide domestic price supports on the output of mines producing up to 2,000 tpy of each metal at 17c-per-lb for lead, 14½c for zinc. Because of its relatively low Federal cost (an estimated $3 to $5-million a year) and election-year political appeal, Kerr and Edmondson sold the Administration on removing its earlier opposition.

Then Kerr got behind new lead-zinc tariff rates proposed by another of the three industry factors, the so-called smelter group led by American Smelting & Refining Co. The third industry group, the Emergency Lead-Zinc Committee, was holding out for the more restrictive

rates provided in a bill introduced by Rep. Howard Baker (R-Tenn.), taken from the Tariff Commission's two-man minority report on lead-zinc last spring.

Kerr got Baker to accept Kerr's rates as a substitute for Baker's in the House Ways & Means Committee, on grounds that the lower duty increases would be preferable to none at all.

Kerr got around another major obstacle raised by House freer-trade leader Rep. Hale Boggs (D-La.) with the heart of his log-roll. While Boggs is an advocate of freer trade, and opposed the lead-zinc duty increases, he also is from New Orleans, (where domestic shrimpers are pressing for import quotas on their foreign competition.) So, Kerr agreed to swap a shrimp quota for the lead-zinc boosts, thus removing Bogg's opposition.

Kerr's biggest problem, however, was a vehicle to hold the compromise he had put together. He found it in a minor Virgin Island tax measure, already passed by the House and pending before the Senate Finance Committee on which Kerr sits.

By tacking the lead-zinc and shrimp restrictions onto that bill, HR 5547, and substituting the Kerr lead-zinc rates for the Baker Bill, Kerr paved the way for the Senate to approve the trade restrictions on the say-so of the Finance Committee, and for the House to agree on the amendments without sending the bill to conference on the basis of the fact that the House Ways and Means Committee already had agreed to the deal.

Kerr also hoped that the Treasury revenue from the Virgin Island tax bill—which is a procedural reform measure—would prevent the President from vetoing the bill just to kill the lead-zinc tariff hikes.

The significance of Kerr's maneuvers will not be lost on domestic business seeking restrictive tariff legislation in the 87th Congress next year. If Kerr proved nothing else, he showed that a Congressional log-roll can be put together. Whether it can be made to stick is another question, one which may not be finally answered for some time.

## Supreme Court Dumps 'Product' Depletion Rate

A PROCEDURAL tax depletion compromise was reached by Senate-House conferees on the question of tax allowances on finished products, shortly before recess of the session. In accordance with a Federal Court ruling last year, upheld 9-0 by the Supreme Court last month, Congress amended provisions in the percentage depletion law under which brick and clay manufacturers have been basing their allowance claims on the price of the finished product.

Under the new provisions, mines may receive depletion tax allowances only on the basis of raw material price, not on the price of the finished product. The new rule affects only those metal-mineral producers with integrated production.

# Labor This Month

**MINE-MILL'S FINANCIAL PINCH:** What was anticipated in the wake of the 1959 nonferrous mine strike shows up in new union financial reports filed with the U.S. Labor Department. The International Mine-Mill & Smelter Workers Union is running in the red to the tune of more than $1-million. The details, which must be filed under the new Labor Reform Law rules, show Mine-Mill's net assets to be $148,101. A further breakdown of MMSW financial status: Cash, $78,025; investments in Government bonds, $83,823, in land and buildings, $44,103.

Mine-Mill's total receipts for its latest fiscal period: $893,193 including $767,482 collected from dues and fees. Its strike expenses for the period covered in the report: $260,785. Its operating deficit, however, is $1,106,118.

**ARBITRATORS GET THE GREEN LIGHT:** More than 90% of all labor-management contracts include arbitration clauses, usually combined with no-strike and no-lockout pledges by the parties. While the decision of an arbitrator is binding on both sides, an aggrieved party frequently will take his case to court to challenge the arbitrator's ruling. Now, the Supreme Court warns the lower courts to keep their hands off these cases. In three key decisions, the High Court holds—in effect—that arbitration is a private matter between labor and management and should not be intruded upon by the courts—even if they disagree with the way the arbitration has gone. "The courts have no business weighing the merits of a grievance," rules Justice William O. Douglas. "The agreement is to submit all grievances to arbitration, not merely those the court will deem meritorious."

**UNION ORGANIZERS AT WORK:** The ups and downs of the union organizing business are revealed in two recent results in Mine-Mill & Smelter Worker territory. The independent nonferrous mine union signed up a new employer—the International Nickel Co. at Thompson Lake, Manitoba. The union anticipates a work force of about 2,000 at the company's mine, smelting and refining properties by 1962. On the debit side, the United Steelworkers won an NLRB election at Kennecott Copper's smelter and refining plant in Baltimore, Md. The Steelworkers beat out the operating engineers after Mine-Mill withdrew from the contest.

**LABOR POLICEMEN TREAD SOFTLY:** Though more than 1200 investigations of Landrum-Griffin reform law violations have been under way, the record so far shows just one conviction. An official of a Puerto Rican longshoremen's local pleaded guilty to embezzlement of union funds. Labor Department investigators who process complaints are being extra cautious, they say, because these first cases will set precedents and probably come up for review in the courts. Of those cases checked out to date, more than half have been dropped for lack of jurisdiction, lack of evidence or other factors. Of those now being actively checked, the cases involve alleged violation of local union elections (113); fiscal mismanagement (85); violation of the Bill of Rights (53), and embezzlement (40).

**UNIONS EYE JOB SECURITY:** In this summer's major electrical negotiations, five big AFL-CIO unions are concentrating on jobs, not wages, as their top goal. Their list of demands offer a peek at labor's big goals for the future, as well as today. Top on the list, supplementary unemployment benefits. Right behind, severance pay for laid-off workers plus a demand that General Electric and Westinghouse—the major industry employers—do not contract out work while their own workers are idle. Pointing up their concentration on keeping the jobs they have now, the unions' initial wage demand was only 3.5%—matching the annual increase being paid in the industry soon-to-expire five-year contracts.

The advance of automation, and its threat to jobs, is becoming a bigger worry to most unions. Like those in the electrical industry, many labor leaders now concentrate on ways to limit the invasion by machines. It also talks, hopefully, of a shorter work week in future years—as the next big step.

# MARKETS

## Copper Prices Jump About in Europe; Lead and Zinc Duty Rise Possible

Nonferrous metal prices in May, according to the E&MJ index, were almost unchanged. The average for the seven metals was 125.9% of the 1947-49 average in May and in April it was 125.8. The only change was a rise in tin to 101.347c in May; in April it was 99.518c a lb.

**Copper prices outside the U.S.** did a lot of bobbing about in June. The explosive situation in the Belgium Congo had much to do with it. Reports from that country suggested that the fighting between tribes and groupings competing for power might interrupt the production and shipment of copper. Europeans were moving out fast and some factors thought insufficient technical personnel would remain to keep the operations going. But most seemed to think there would be no interruption.

European consumption of raw copper was at a high rate though probably not as high as the heavy shipments would suggest. Some was being stocked in case of a failure of shipment later.

Late in the month a dock strike in the U.K. boosted prices and increased the spread between prompt and three months copper. But most of the spread was between current and copper priced a week or two ahead. This indicated a shortage for the spot position and less concern about the copper supply farther ahead. A shortage of warehouse copper made the LME susceptible to sharp movements.

**Prices in the U.S.** charged by producers and custom smelters were unchanged.

Rumors persisted that one of the U.S. custom smelters was selling copper for delivery in July and maybe later for well under the 33c announced price. The rumors were based on the low price of scrap. Two of the custom smelters were practically out of the market for scrap—they had a great backlog from the period when they were struck. With only one smelter active in the market, scrap could be bought at a price which would permit its sale as refined metal at 30c to 31c a lb. Some factors felt it would be good business to sell ahead at a flat price of 32c or a little more.

**Copper shipments to fabricators** in May continued at a very high rate. World shipments were 319,134 tons, about 100 over the previous month which had been a record. It was in shipments to fabricators outside the U.S. that a big buyers rush came. They took 210,868 tons, far more than ever before. Uncertainty about the future supply was behind it. Shipments to U.S. fabricators were 108,266 tons, down about 21,000 from April.

Shipments of fabricated copper by U.S. firms dropped in May to 107,838 tons. This was down about 6,000 tons, but about equal to the March figure.

**Primary aluminum producers** in the U.S. will probably have to accommodate another member. United Pacific Aluminum Corp., a Los Angeles fabricator, is planning to erect an aluminum smelter on the Columbia River near Longview, Wash., according to Washington State Governor Albert D. Rossellini. Production may begin in 1961.

Reports are that United Pacific first went to Pechiney, the large French aluminum producer, to get help in setting up the plant. But Pechiney turned United down. It then arranged to get help from the large Swiss producer. This did not please some of the other primary producers. The company is expected to put up a 20,000 tpy potline at a cost of about $20-million. It was one of five firms, along with Harvey Aluminum, that put in bids in June for Bonneville power.

There is widespread belief among primary producers that the more firms enter the industry, the less is the chance of maintaining high and stable prices for pig aluminum. The sharp price cutting of a year or two ago was attributed in part to the newer firms in the industry.

Shipments of aluminum sheet and plate moved up in May according to Aluminum Assn. figures. In May 70,602 tons were shipped; the April figure, when one more firm reported, was 65,471 tons.

**Lead sales in the U.S. were off** in May. Sales reported by the various companies to E&MJ totaled about 38,000 tons; in April reported sales were about 58,000. Buyers had been taking good amounts, partly with the view the price could not drop and just might rise. But as some hesitancy continued in the U.S. economy and their stocks were at a good level their buying eased. Prices on the London Metal Exchange eased about ⅜c during the month.

American Bureau of Metal Statistics lead data for April and May in short tons:

| | Apr. | May |
|---|---|---|
| Stock, beginning | 109,148 | 118,329 |
| Production | 40,177 | 36,509 |
| Total Supply | 149,325 | 154,838 |
| Shipments: | | |
| U.S. consumer | 30,686 | 31,690 |
| Exports | ... | ... |
| (a) Other | 300 | ... |
| Total | 30,986 | 31,690 |
| Stock at end | 118,329 | 123,148 |

(a) Presumably U.S. Government.

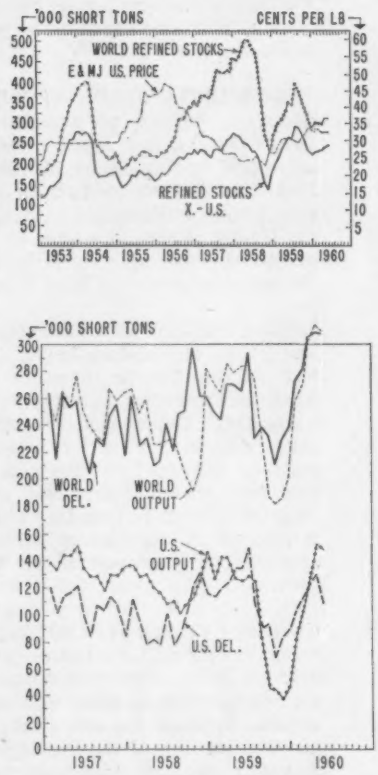
The attempt to help further U.S. miners appeared to make some progress. The Kerr Bill was given some chance of success. It calls for a duty of 2c a lb on lead and 1½c on zinc. There would be an additional import duty of 1c on lead when the price is 13½c or below and an additional 1c on zinc when the price is 12½c or below. The added 1c would remain on lead until the price rose to 14½c and the 1c would remain on zinc until the price rose to 13½c a lb. The fact that the total duty applies to a range, some smelters say, makes it more acceptable since it will probably be more stable. The duty on ores would be 70% of the metal duty. The duty will be applied on a quarterly rather than a monthly basis.

The bill has been attached to a Virgin Islands tax bill as an amendment.

**Zinc sales** remained slow though during the last week they reached the highest weekly rate since early January. Some factors indicated consumers had been buying less than they consumed and, therefore, were unable to remain out of the market.

Zinc prices in Europe were rather steady throughout June. Late in the month the price was about 11¼c for prompt metal.

### Copper Production and Stocks




Data, except price, are from the Copper Institute and are in thousands of short tons. They include May 1960. World refined output and stocks do not include the U.S.S.R., Japan, the Scandinavian countries, Yugoslavia, and the Mesina Mine in Transvaal. The series "X-U.S." are the above world stock statistics less the U.S. No fabricator stocks are included. Beginning with January 1960 the C. I. includes data for mines formerly excluded.

## Average Prices June (E&MJ Quotations)

Cents per lb unless otherwise indicated:

| | |
|---|---|
| **Copper:** | |
| Electro, domestic refinery | 32.600 |
| Electrolytic, export refinery | 30.290 |
| Electrolytic, c.i.f. Cont'l ports | 31.235 |
| **Lead:** | |
| Common, New York | 12.000 |
| Common, St. Louis | 11.800 |
| **Silver:** | |
| Silver, New York, per oz | 91.375 |
| Silver, London, pence per oz | 79.250d |
| **Zinc:** | |
| Prime, Western, East St. Louis | 13.000 |
| Prime, Western, delivered (g) | 13.500 |
| **Tin:** | |
| New York Straits | 101.347 |
| **Gold,** per oz, U.S. price | $35.000 |
| **Sterling, Exchange** | 280.268 |
| **Quicksilver, per flask** | $211.273 |
| **Antimony,** (E&MJ) (d) | 32.590 |
| **Antimony,** bulk, Laredo | 29.000 |
| **Antimony,** in cases, Laredo | 29.500 |
| **Antimony** for. 99% | 22.875(h) |
| **Palladium,** troy oz | $24.000 |
| **Platinum,** refined, per oz | 82.000 |
| **Cadmium** (a) | 140.000 |
| **Cadmium** (b) | 150.000 |
| **Al,** 99½% dom., ingot | 28.100 |
| export, pig | 23.250 |
| **Magnesium,** ingot | 35.250 |
| **Nickel,** (f) | 74.000 |
| **Bismuth** | $2.250 |
| **Cobalt** | $1.500 |

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 2c duty extra.

## Free Gold Market

Volume of international gold dealings declined 11% as Soviet sales diminished to about 10 tons. Bar gold prices were practically unchanged in Europe and the Far East but were lower in Indian markets. Coin prices were slight in Western dealings. London remained the most active center. Dealings in Paris declined while other European, especially Zurich, were brisk. Gold futures were again not in demand. Premiums of 1-yr options listed at 6% in London and 4-4½% p.a. in Zurich. Transactions were small averaging about $250,000 daily. U.S. gold outflow continued reducing the stock to $19.323-billion, a new low. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

| | Coins | | Bars | |
|---|---|---|---|---|
| | May 31 | June 30 | May 31 | June 30 |
| NEW YORK transit | | | $35.08⅛ | $35.08⅛ |
| MANILA | $39.75 | $39.85 | 35.70 | 35.75 |
| HONG KONG | 47.95 | 48.15 | 38.80 | 38.70 |
| BOMBAY | 55.50 | 52.75 | 54.00 | 52.50 |
| BEIRUT | 39.35 | 39.50 | 35.22 | 35.26 |
| PARIS | 38.75 | 38.80 | 35.41 | 35.35 |
| BUENOS AIRES | 38.90 | 38.90 | 35.50 | 35.55 |

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

## Custom Smelter Copper

Based on flat price and E&MJ average price sales in U.S. for month of June reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

| | |
|---|---|
| Delivered consumer's plant | 32.750 lb |
| F. o. b. refinery | 32.350 lb |

## Major Metals

### U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

| June 1960 | Electrolytic Copper (a) Domestic | (b) Export | Europe c.i.f. (c) | Lead New York | Lead St. Louis | Zinc (f) Delivered | Zinc East St. Louis | Aluminum Primary 99% U.S. Dest. | Straits Pig Tin New York |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 32.600 | 29.300 | 30.245 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 100.125 |
| 2 | 32.600 | 29.125 | 30.070 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 100.500 |
| 3 | 32.600 | 29.425 | 30.370 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 100.750 |
| 6 | 32.600 | — No Market — | | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.000 |
| 7 | 32.600 | 29.550 | 30.495 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.000 |
| 8 | 32.600 | 29.725 | 30.670 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.000 |
| 9 | 32.600 | 29.525 | 30.470 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.250 |
| 10 | 32.600 | 29.675 | 30.620 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.500 |
| 13 | 32.600 | 30.100 | 31.045 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.250 |
| 14 | 32.600 | 29.850 | 30.795 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.000 |
| 15 | 32.600 | 30.250 | 31.195 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.375 |
| 16 | 32.600 | 30.375 | 31.320 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.500 |
| 17 | 32.600 | 30.450 | 31.395 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.625 |
| 20 | 32.600 | 30.475 | 31.420 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.500 |
| 21 | 32.600 | 30.725 | 31.670 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.500 |
| 22 | 32.600 | 31.225 | 32.170 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.875 |
| 23 | 32.600 | 31.375 | 32.320 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.875 |
| 24 | 32.600 | 31.150 | 32.095 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.625 |
| 27 | 32.600 | 31.050 | 31.995 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.750 |
| 28 | 32.600 | 31.275 | 32.220 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.625 |
| 29 | 32.600 | 30.775 | 31.720 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.875 |
| 30 | 32.600 | 30.700 | 31.645 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 102.125 |
| **AVERAGES FOR MONTH** | | | | | | | | | |
| June | 32.600 | 30.290 | 31.235 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.347 |
| **AVERAGES FOR WEEK** | | | | | | | | | |
| June | | | | | | | | | |
| 1 | 32.600 | 29.210 | 30.155 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 100.094 |
| 8 | 32.600 | 29.456 | 30.401 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 100.850 |
| 15 | 32.600 | 29.880 | 30.825 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.275 |
| 22 | 32.600 | 30.650 | 31.595 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.600 |
| 29 | 32.600 | 31.125 | 32.070 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.750 |
| **CALENDAR WEEK AVERAGES** | | | | | | | | | |
| June | | | | | | | | | |
| 3 | 32.600 | 29.160 | 30.105 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 100.344 |
| 10 | 32.600 | 29.619 | 30.564 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.150 |
| 17 | 32.600 | 30.205 | 31.150 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.350 |
| 24 | 32.600 | 30.990 | 31.935 | 12.000 | 11.800 | 13.500 | 13.000 | 26.000 | 101.675 |

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U. S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deduced.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver 999 fine as made to Handy & Harman for nearby delivery at New York by regular supplies in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price of which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis 999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

## Silver, Gold and Sterling

### DAILY AND AVERAGE PRICES

| June 1960 | Silver (c) New York | Silver London | Sterling Exchange | Gold (d) London |
|---|---|---|---|---|
| 1 | 91.375 | 79.250d. | 280.0760 | 250s. 5¾d. |
| 2 | 91.375 | 79.250d. | 279.9066 | 250s. 8d. |
| 3 | 91.375 | 79.250d. | 280.1350 | 250s. 6¼d. |
| 6 | 91.375 | Holiday | 280.1600 | Holiday |
| 7 | 91.375 | 79.250d. | 280.1250 | 250s. 5¼d. |
| 8 | 91.375 | 79.250d. | 280.0720 | 250s. 6½d. |
| 9 | 91.375 | 79.250d. | 280.1060 | 250s. 7¾d. |
| 10 | 91.375 | 79.250d. | 280.1000 | 250s. 6¾d. |
| 13 | 91.375 | 79.250d. | 280.0740 | 250s. 6¾d. |
| 14 | 91.375 | 79.250d. | 280.1400 | 250s. 6¾d. |
| 15 | 91.375 | 79.250d. | 280.2420 | 250s. 5¼d. |
| 16 | 91.375 | 79.250d. | 280.2400 | 250s. 4¾d. |
| 17 | 91.375 | 79.250d. | 280.1780 | 250s. 5½d. |
| 20 | 91.375 | 79.250d. | 280.2180 | 250s. 6d. |
| 21 | 91.375 | 79.250d. | 280.2980 | 250s. 5½d. |
| 22 | 91.375 | 79.250d. | 280.2820 | 250s. 4½d. |
| 23 | 91.375 | 79.250d. | 280.5800 | 250s. 5½d. |
| 24 | 91.375 | 79.250d. | 280.5500 | 250s. 1¾d. |
| 27 | 91.375 | 79.250d. | 280.5300 | 250s. 1¾d. |
| 28 | 91.375 | 79.250d. | 280.5420 | 250s. 2½d. |
| 29 | 91.375 | 79.250d. | 280.6725 | 250s. 1d. |
| 30 | 91.375 | 79.250d. | 280.6625 | 250s. 1d. |
| **AVERAGES FOR MONTH** | | | | |
| June | 91.375 | 79.250d. | 280.268 | — |
| **AVERAGES FOR WEEK** | | | | |
| June | | | | |
| 1 | 91.375 | — | 280.271 | — |
| 8 | 91.375 | — | 280.080 | — |
| 15 | 91.375 | — | 280.132 | — |
| 22 | 91.375 | — | 280.243 | — |
| 29 | 91.375 | — | 280.575 | — |

Calendar Week Averages: New York Silver: June 3, 91.375; June 10, 91.375; June 17, 91.375; June 24, 91.375.

# MARKETS (*Continued*)

## London Metal Exchange Quotations

| June 1960 | Copper Cash Bid | Copper Cash Asked | Copper 3 Mon. Bid | Copper 3 Mon. Asked | Lead Current Month Bid | Lead Current Month Asked | Lead 3 Mon. Bid | Lead 3 Mon. Asked | Zinc Current Month Bid | Zinc Current Month Asked | Zinc 3 Mon. Bid | Zinc 3 Mon. Asked | Tin Cash Bid | Tin Cash Asked | Tin 3 Mon. Bid | Tin 3 Mon. Asked |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 240½ | 241 | 238¾ | 239 | 76½ | 76¼ | 76⅝ | 76½ | 91¼ | 91½ | 90¾ | 91 | 782 | 782½ | 783½ | 784 |
| 2 | 245¼ | 245½ | 242¼ | 242½ | 76 | 76⅛ | 76⅝ | 76½ | 91⅝ | 92 | 91¼ | 91½ | 785 | 786 | 786½ | 787 |
| 3 | 246¾ | 247 | 242½ | 243 | 76⅛ | 76¼ | 76¾ | 76⅞ | 91⅞ | 91⅞ | 90¾ | 90⅞ | 786 | 786½ | 786½ | 787 |
| 6 | Holiday | | | | | | | | | | | | | | | |
| 7 | 248¼ | 248½ | 243¾ | 244 | 75¼ | 75⅝ | 76 | 76⅛ | 90⅝ | 91 | 90½ | 90⅝ | 785 | 785½ | 786 | 786½ |
| 8 | 244¾ | 245 | 240½ | 240¾ | 73½ | 73⅞ | 74⅝ | 74½ | 89¾ | 90 | 89¾ | 89⅞ | 785 | 785½ | 785 | 785½ |
| 9 | 245 | 245¼ | 240⅝ | 241 | 74 | 74⅛ | 74¼ | 74½ | 89⅞ | 90¼ | 90 | 90¼ | 790 | 790½ | 789½ | 790 |
| 10 | 246 | 246½ | 241⅝ | 242 | 74⅝ | 74⅞ | 74⅝ | 74¾ | 90 | 90¾ | 90 | 90½ | 789½ | 790 | 788 | 788½ |
| 13 | 246¼ | 246½ | 241⅝ | 242 | 74½ | 74⅝ | 74⅝ | 74¾ | 89⅝ | 90 | 89⅞ | 90 | 788½ | 789 | 787 | 788 |
| 14 | 247¾ | 248 | 242½ | 242¾ | 72⅝ | 73 | 73⅞ | 74 | 89½ | 89¾ | 89⅞ | 90 | 789 | 789½ | 787 | 787½ |
| 15 | 250½ | 251 | 244¾ | 245 | 72¾ | 73 | 74 | 74⅛ | 89¾ | 90 | 90 | 90¼ | 793½ | 794 | 789 | 790 |
| 16 | 251¼ | 252 | 245¾ | 246 | 73¼ | 73½ | 73¾ | 73⅞ | 90 | 90¼ | 90 | 90¼ | 797 | 797½ | 789 | 790 |
| 17 | 252½ | 253 | 246¾ | 247 | 73⅝ | 73¾ | 73⅞ | 74⅛ | 90⅛ | 90½ | 90¼ | 90½ | 797 | 798 | 788½ | 789 |
| 20 | 253½ | 254 | 246½ | 246½ | 73¾ | 73⅞ | 74⅛ | 74⅜ | 90⅜ | 90½ | 90 | 90¼ | 796 | 796½ | 788½ | 789½ |
| 21 | 255½ | 256 | 246½ | 246¾ | 72¾ | 72⅞ | 73½ | 73⅝ | 90¼ | 90⅜ | 89⅞ | 90 | 796 | 797 | 789 | 789½ |
| 22 | 257¼ | 257½ | 247½ | 247¾ | 72½ | 72⅝ | 73¼ | 73⅝ | 91¼ | 91⅜ | 90¼ | 90⅝ | 797½ | 798 | 791½ | 792 |
| 23 | 257½ | 258 | 247½ | 248 | 71¾ | 71⅞ | 72¼ | 72⅝ | 91⅛ | 91¼ | 90 | 90¼ | 797 | 797½ | 791 | 792 |
| 24 | 253 | 254 | 244¾ | 245 | 71½ | 71⅝ | 72⅜ | 72½ | 90½ | 91¼ | 90 | 90½ | 795½ | 796 | 790½ | 791 |
| 27 | 258 | 258½ | 245½ | 246 | 71½ | 71¾ | 72½ | 72⅝ | 90½ | 90⅝ | 89¾ | 89½ | 798 | 798½ | 791½ | 792 |
| 28 | 256 | 256½ | 245 | 245½ | 70½ | 70⅝ | 71⅞ | 72 | 90½ | 90½ | 89⅝ | 89½ | 799 | 800 | 792 | 792½ |
| 29 | 249 | 249½ | 243 | 243½ | 70¾ | 70⅞ | 72 | 72¼ | 90½ | 90¾ | 89¾ | 90 | 799 | 800 | 791 | 791½ |
| 30 | 256½ | 257 | 245½ | 246 | 71½ | 71⅝ | 72½ | 72¾ | 90⅝ | 90¾ | 89½ | 90 | 806 | 807 | 795½ | 796 |

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

## Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

### MISCELLANEOUS METALS

June 30, 1960

| | | |
|---|---|---|
| Aluminum ingot, 99 plus % lb | | 28.1c |
| Antimony, spot, lb, less than carload, in cases | | 32.59c |
| In bulk, carload lots, f.o.b. Laredo | | 29.00c |
| Imported, 10 ton min. (p), 99% Duty not paid | 22¾ — | 23c |
| Bismuth, ton lots, lb | | $2.25 |
| Cadmium, ton lots delivered, lb | | $1.40 |
| small lots | | $1.50 |
| Calcium, lb, ton lots, 98%, cast | | $2.05 |
| Chromium, 97% grade, lb, contract delivered | | $1.29 |
| Cobalt, 97 to 99%, per lb effective 3-1-60 | | $1.50 |
| Germanium, per gram, 10,000 gram lots | (d)28.15c—(c) | (d)29.95c |
| Indium, troy oz | $1.35 — | $2.25 |
| Lithium, lb, 98% | $9.00 — | $11.00 |
| Nickel, cathodes, lb (a) | | 74c |
| Other sales, regular sellers | | 74c |
| Sales by dealers, etc | | 74c |
| Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16 | | 35¼ |
| Palladium, troy oz | $24 — | $26 |
| Platinum, troy oz | $81 — | $85 |
| Quicksilver, flask of 76 lb, 25 flasks or more | $211 — | $214 |
| Selenium, 99 plus %, lb—(Feb. 19, 1958) | | $7.00 |
| Silicon, minimum 98%, carloads, lb | | 19c |
| Semi Conductor grade, lb | | $360 |
| Tellurium, lb | | $3.50 |
| Thallium, 100 lb or more | | $7.50 |
| Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b) | $1.50 — | $1.60 |

(a) Effective Dec. 6, 1956; including U. S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

### METALLIC ORES

| | | |
|---|---|---|
| Beryllium ore, imported, 10% BeO, (b) stu; spot | $31.75 — | $32.50 |
| term contracts | $34 — | $34.50 |
| Chrome ore per long ton, f.o.b. cars Atlantic ports, dry: | | |
| 44% $Cr_2O_3$ no ratio | (a)$19.75 — | $20.50 |
| 48% $Cr_2O_3$ 3 to 1 ratio | $35¾ — | $38 |
| Iron ore, Lake Superior, Lower Lake ports, lt | | |
| Old Range bessemer | | $11.70(e) |
| Mesabi bessemer | | $11.60(e) |
| Mesabi non bessemer | | $11.45(e) |
| Lead (Galena), 80%, Joplin, Mo., ton | | $141.72 |
| Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.l.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal. | | |
| Molybdenum ore, 90%, per lb of Mo f.o.b. mines | | $1.25 |
| Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio | $1.18 — | $1.25 |
| Tungsten ore, per stu of $WO_3$: | | |
| Foreign 60%, c.l.f. U. S. ports, duty extra | $20 — | $20.25 |
| U. S. scheelite, f.o.b. mill | $24 — | $25 |
| Vanadium ore, per lb of contained $V_2O_5$ f.o.b. mines | | 31c |
| Zinc ore, Prime, 60% concentrate, Joplin, Mo., per ton | | $80 |

(a) Nominal. (b) c.l.f. U. S. ports. (e) Effective 1958 shipping season.

### METALLIC COMPOUNDS

| | | |
|---|---|---|
| Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks | | 4-5c |
| Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960 | $1.15 — | $1.18 |
| Copper sulphate, 100 lb. effective Nov. 6, '59 | | $13.00 |
| Germanium dioxide, gm | | 16½c |
| Molybdic trioxide, technical, per lb of Mo | $1.46 — | $1.47 |
| Imported, including 37c duty | $1.75 — | $2.05 |

### ALLOYS

| | | |
|---|---|---|
| Ferrochrome 65 to 70%, per lb of Cr, (4-9% C) | | 28¾c |
| Ferromanganese, 74 to 76%, per lb shipping point | | 11c |
| Ferromolybdenum, 58 to 64% Mo. lb of Mo contained | $1.50 — | $1.82 |
| Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957) | | 14.60c |
| Ferrotungsten, 72 to 82%, lb of W contained | | $2.15 |
| Ferrovanadium, per lb of V delivered | $3.20 — | $3.40 |
| Silicomanganese, max. 1½% C, lb contracts | | 11.6c |
| Spiegeleisen, per lt, 19—21% grade effective Jan. 22 | $100.00 — | $102.50 |

### NONMETALLIC MINERALS

| | | | |
|---|---|---|---|
| Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton: | | | |
| Crude No. 1 | $1,400–$1,725 | Paper Stock | $120–$142 |
| Crude No. 2 | $750–$1,100 | Waste | $75– $86 |
| Spinning Fibers | $350– $565 | Shorts | $22– $75 |
| Shingle fibers | $180– $220 | | |
| Asbestos, f.o.b., Vancouver, B. C. (Canada funds): | | | |
| Crude No. 1 | $1,522 | Spinning fibers | $220–$787 |
| Asbestos, Vermont, f.o.b. Morrisville: | | | |
| Spinning fibers | $353– $408 | Waste, stucco or plaster | $86 |
| Shingle stock | $181– $218 | | |
| Paper stock | $120– $142 | Refuse or shorts | $41– $75 |
| Barytes, f.o.b. cars: | | | |
| Georgia, crude, per ton | | | $18 |
| Missouri, 94%, $BaSo_4$, per st | $16 — | | $18 |
| Crude oil well grade, min. 4.3 sp gr, st (a) | | | $18 |
| Imported, c.l.f. Gulf Ports, st | $16 — | | $18 |
| Bauxite, st, f.o.b. point of shipment: | | | |
| Domestic, crude, 50%, 8% Fe, 13% Si | (c)$12.25 — | | $13.50 |
| Imported metallurgical, per lt, f.o.b. Br. Guiana, 60% $Al_2O_3$, 6% $SiO_2$, 1.25% Fe, 1–1–60 | | | $7.25 |
| Feldspar, bulk ton; f.o.b. plants: | | | |
| Potash or soda feldspar, 200 mesh, ceramic grade | $17 — | | $20.50 |
| Glass feldspar, white, 20 mesh | | | $9 |
| Fluorspar, f.o.b. mines, bulk, 72½% effective, ton | $37 — | | $41 |
| 60% effective $CaF_2$ | $33 — | | $36 |
| Acid 97% concentrate, bulk, ton | | | $45.00 |
| Fuller's earth, f.o.b. Georgia or Florida, ton | $7.00 — | | $14.00 |
| Magnesite, per ton dead-burned, bulk, f.o.b. Washington | | | $46 |

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in. 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in, $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton, Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

| | | |
|---|---|---|
| Ochers, Georgia, ton in sacks | $26.50 — | $32.00 |
| Sulphur, long ton, U. S. producers' posted quotations* | | |
| f.o.b. mines, bright | | $23.50 |
| dark | | $22.50 |
| f.o.b. vessel, U. S. ports, bright | | $25.00 |
| dark | | $24.00 |

*Prices will vary from these depending on the competitive situation; currently U. S. sulphur sells at close to Mexican export prices.

| | | |
|---|---|---|
| Mexican, for use in Mexico, per metric ton, f.o.b. mines, depending on location | $21.00 — | $23.00 |
| For export f.o.b. vessel, lt, depending on grade | $20.50 — | $22.00 |
| Talc, f.o.b. works, ton: | | |
| New York, purified | $18.00 — | $20.00 |
| Vermont, extra fine | | $12.50 |
| Tripoli, Missouri, ton: | | |
| 40-mesh, cream colored | | $50.00 |

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

### IRON AND STEEL

| | | |
|---|---|---|
| Pig iron, gross ton, basic, Valley furnaces | | $66.00 |
| Steel, f.o.b. Pittsburgh, billets, net ton | | $80.00 |
| Structural shapes, Pa., Ala., etc., 100 lb | $5.30 — | $5.50 |

B.F.Goodrich

# 50-ton loads of coal take a 5,000-hour ride on B.F.Goodrich tires

DAILY production at the Fiatt, Illinois, mine of the Truax-Traer Coal Co. is 7,300 tons. Coal is hauled to the tipple over roads made of crushed limestone. Loads average 50 tons—yet estimated service on the original tread of the B.F.Goodrich Rock Service tires is 5,000 hours!

## New long-wear tire compounds

Now Rock Service tires are available in 2 new B.F.Goodrich compounds that tests show outperform any others on the market. Yet they *cost no more* than conventionally made tires. Cut Protected compound gives longer service where:

- Cutting and chipping are severe.
- Round-trip hauls are short.
- Trucks travel at low speeds.

Heat Resistant compound defies dangerous heat build-up where:

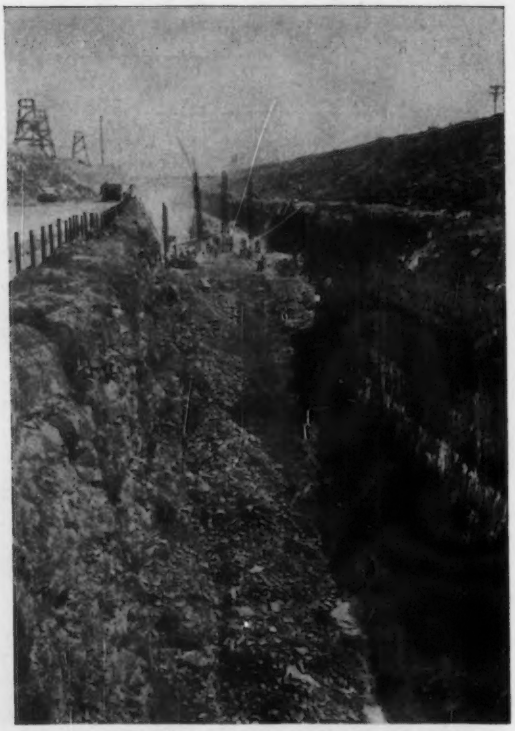
- Haul roads are well maintained.
- Trucks travel at high speeds.
- Cutting is negligible.

Intensive B.F.Goodrich research and testing went into the development of these compounds. Only B.F.Goodrich makes Cut Protected, Heat Resistant and Regular compound tires that are actually tailor-made for your type of work. Your B.F.Goodrich Smileage dealer will recommend the best one for you. He's listed under Tires in the Yellow Pages. *The B.F.Goodrich Company, Akron 18, O.*

***Specify*** **B.F.Goodrich Tubeless or tube-type tires when ordering new equipment.**

# Around the country with BETHLEHEM HOLLOW

**NEW DAM IN ARIZONA.**
Bethlehem Hollow chews into a rugged sandstone face at site of Glen Canyon Dam, on Colorado River. The new dam, 1500 ft across crest, and rising 580 ft above the river, will join the sheer 700-ft-high canyon walls.



**4-MILE TRENCH FOR NIAGARA POWER PROJECT.**
Blast holes being bored with Bethlehem Hollow in section of 4-mile trench at Niagara Power Project. The completed trench will hold twin water conduits, to carry Niagara River water to new power plant below Niagara Falls.

**NEW WATER TUNNEL FOR NEW YORK CITY.**
Bethlehem Hollow is shown at work near No. 6 Shaft of West Delaware Tunnel, at Livingston Manor, N. Y. The 44-mile tunnel will augment New York's water supply system.

Bethlehem Hollow holds down your drilling costs, even in the hardest types of rock . . . because it's rolled from steel specially developed for toughness, and resistance to fatigue.

Bethlehem Hollow comes in Carbon and Ultra Alloy grades, in rounds, hexagons, and quarter-octagons. It is regularly furnished in 18 ft to 27 ft lengths. Be sure to use Bethlehem Hollow on your next rock removal job.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

# "WHAT CAN A TILTING PAN FILTER DO FOR ME?"

## It Can Handle Materials That Are Too Free-Filtering for Vacuum Pick-Up

Effective filtration of a broad category of rapid settling and dewatering slurries that require intensive washing can be accomplished only on horizontal pan filters especially designed for this feed.

Eimco's leadership in engineering a succession of advanced design features into this specialized filter has so improved its performance that the usefulness of the unit has been greatly extended. Modern Eimco Tilting Pan filters have been applied for continuous processing of such materials as phosphoric acid, beryllium, iron ore fines.

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Eimco Tilting Pan filters provide close control of washing, dewatering, drying, air sweep. One, two, three or more displacement wash separations can be made every filter cycle. Amounts of wash water and cake on each pan can be balanced precisely. Uniformity of wash water distribution can be controlled.

Cloth media on each pan is spray cleaned after cake discharge. A new and exclusive Eimco vacuum purge then removes any cleaning water left in the lower corner of each pan.

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**Contains valuable information on the use and economics of this special filter. Ask the Eimco Representative in your area for your copy or write Eimco Filter Division for**

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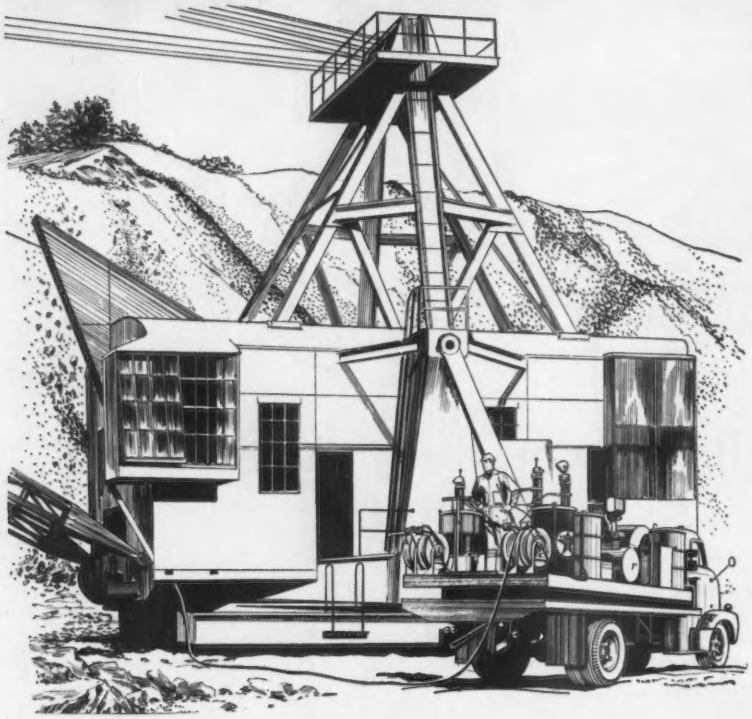
# LUBE LOGIC

## 3 Maintenance Shortcuts



### HOW HIGH IS YOUR HIDDEN COST OF MAINTENANCE?

You may not realize how many extra maintenance dollars you spend when you keep too many lubricants on hand. (Six are usually all you need for all major lubrication.) You pay extra for inventory. You pay extra for storage and handling. It costs you more in paperwork to order. And you'll have to figure the wasted cost of equipment parts and downtime if misapplication should occur.

*The Texaco Lubrication Plan* helps you reduce or even eliminate these hidden costs. That's because it provides the *minimum* number of *proven* multi-purpose and specialty lubricants, tailored to your job requirements.

You'll do yourself a favor when you check with a Texaco Lubrication Engineer. He'll plan your lubrication needs carefully—then follow them up to see that your lubrication problems are taken care of fast.

### THE INSIDE STORY ON OUTSIDE STORAGE

You're short-changing yourself if you skip these simple precautions: Drums stored outside should be placed on their sides. When they are stored on end, expansion and contraction through temperature changes can suck in rain water that collects on top of the drum—*even if the drum has never been opened!*

Want to warm up lubricants that have become stiff from cold? *Don't* use an open flame. This may cause drum leakage or even ruined lubricant. Instead, put the drum inside for awhile before using.

### NEW WAY TO KEEP RUST OUT OF YOUR RADIATOR

Rust in your cooling system can start damaging your engine long before your radiator blows its top. Don't let it start. Some antifreezes—such as Texaco PT Anti-Freeze—will do the job in winter, but in summer you can get protection for pennies with a 1 to 2% solution of Texaco Soluble Oil C.

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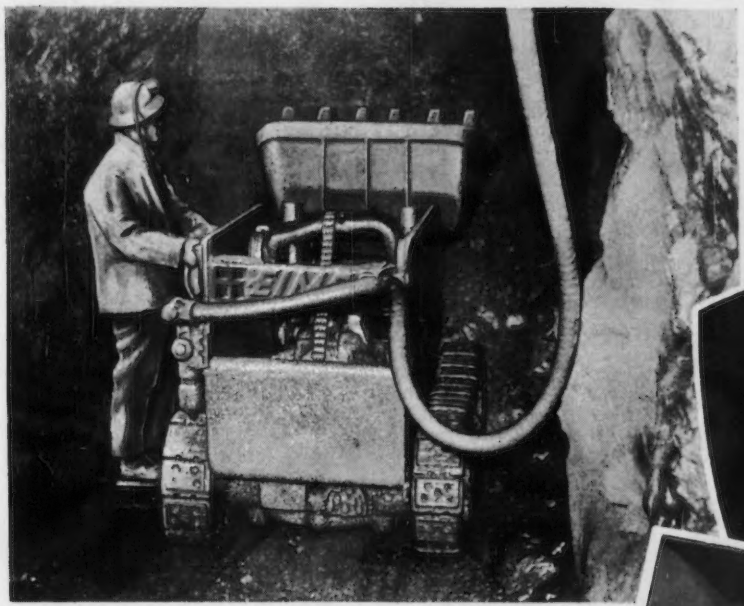
*Throughout the United States*

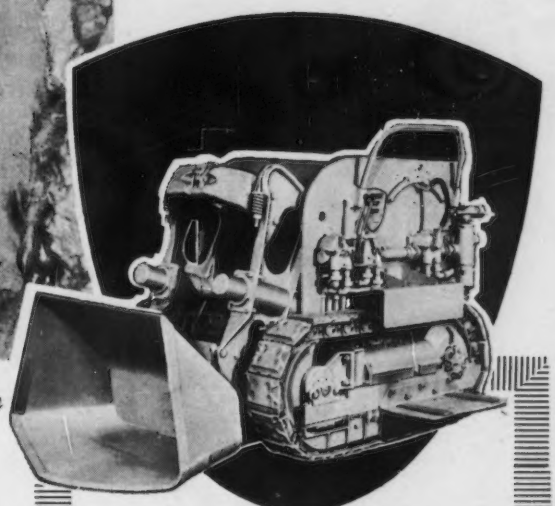
*Canada • Latin America • West Africa*

# 1500 tons daily

## WITH EIMCO 630 EXCAVATORS



*Photograph – Courtesy of Maritime Mining Corporation*



Eimco 630's handle three-quarters of the daily production of 2,000 tons at The Maritime Mining Corporation in the Green Bay District of Newfoundland. When required, individual machines, working continuously, have loaded up to 600 tons in eight hours. The required average for each machine per shift is 340-350 tons.

Over a checking period of two months, maintenance costs averaged only $0.05 per ton including labor and parts!

You just can't beat an Eimco for economical drawpoint loading . . . or for mucking in shafts, tunnels, big slopes, in developments and in production.

Get all the facts on the great Eimco 630 Excavator. Contact your nearest Eimco dealer or branch, or write The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah.

**EIMCO 630 FEATURES**

- **Independent track control**
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- **Adjustable digging depth**
- **Anti-friction roller bearings**
- **Sturdy alloy cast steel rocker arms**
- **Air or Electric powered**
- **Low Maintenance — High Production**

**"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"**

**THE EIMCO CORPORATION**

**MINING EQUIPMENT DIVISION**

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**EXPORT OFFICE: 51 - 52 SOUTH STREET, NEW YORK, N. Y.**
**BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD**

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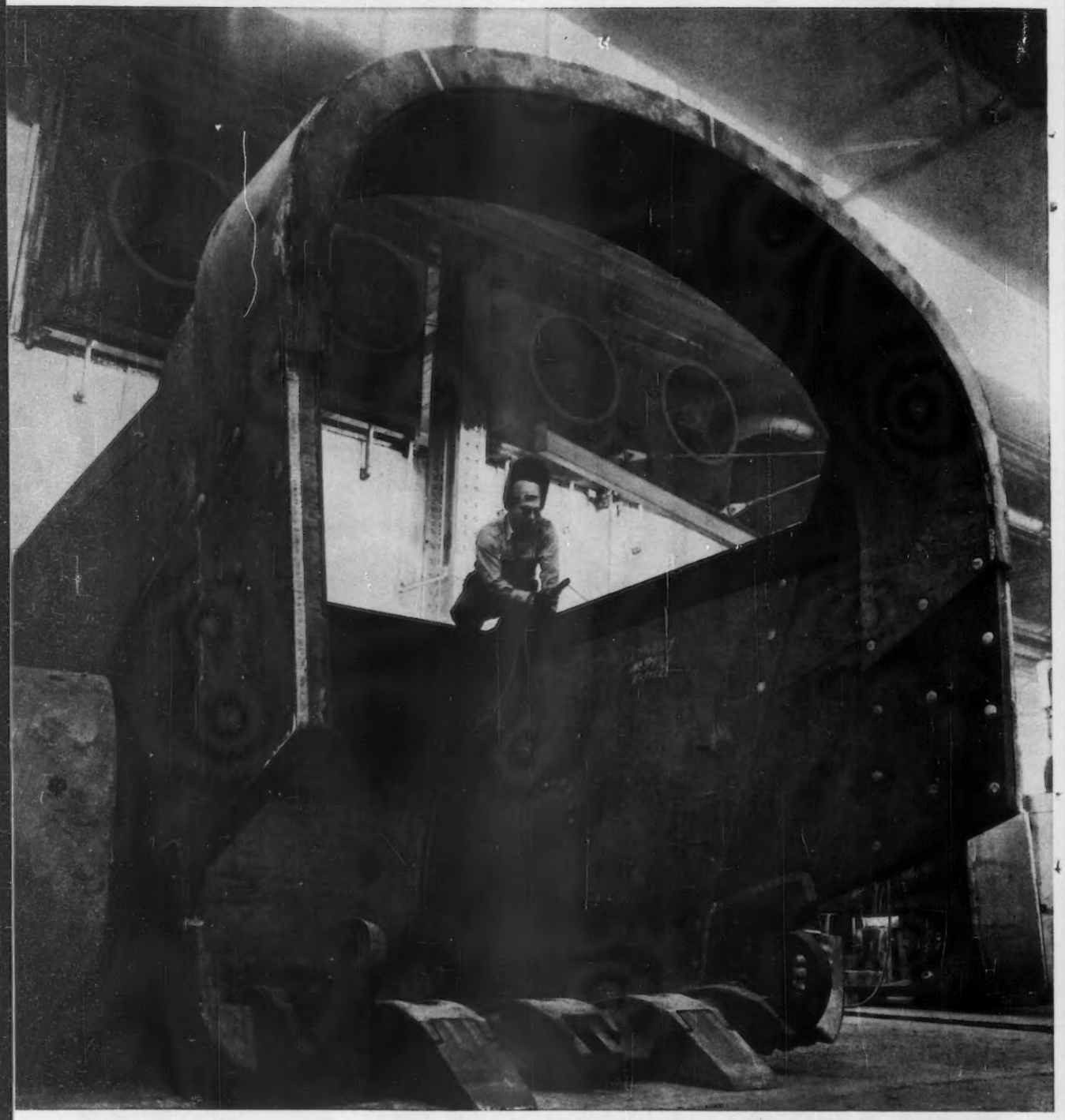
# Bucket built 2½ tons



15% increase in capacity—14% weight reduction in this USS "T-1" Steel 15-yard dragline bucket for India.

This mark tells you a product is made of modern, dependable Steels.

# lighter with USS "T-1" Steel

A new 15-cubic-yard Page AUTOMATIC Dragline Bucket for service in India makes maximum use of USS "T-1" Constructional Alloy Steel that cuts dead weight, increases capacity and boosts service life as much as five times. Designers increased capacity of this bucket 15%. Ten tons of USS "T-1" Steel were used in the bucket in plate thicknesses of 2¼", ¾", ⅝" and ½".

"T-1" Steel bucket yields 20 months' continuous service for DeLauter Coal Company. Mr. Roy DeLauter, Superintendent of DeLauter Coal reports, "Our Page AUTOMATIC Dragline Bucket, made of "T-1" Steel, has worked 24 hours a day, continuously for 20 months, stripping earth and lime rock from our seam which is buried some 80 feet in the ground. We've never had, heard of, or seen another bucket like it. It has given us five times as much trouble-free service as any other kind of material on the market. Why, during these 20 months, this bucket was never off the rig! And it's practically unheard of to run a stripping machine without a spare bucket. Yet we neither had a spare nor ever needed one."

In addition to this performance by USS "T-1" Steel at the 100,000 psi yield strength level for shovel booms, dozer blades, trailer bodies and mine cars, United States Steel also offers three other grades of steel at the 50,000 psi yield point level.

Depending on the economics and design involved, USS MAN-TEN, COR-TEN, and TRI-TEN brands of High Strength Steel also offer lighter weight construction with lower costs. USS MAN-TEN Steel features increased strength with high abrasion resistance for bolted or riveted construction. USS COR-TEN Steel is noted for higher strength with superior resistance to atmospheric corrosion. USS TRI-TEN offers strength and toughness with excellent weldability.

For long-life screens, USS Stainless Steel can't be beat. For more information on these special steels, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

*USS, "T-1", COR-TEN, MAN-TEN and TRI-TEN are registered trademarks*

*Five times more life* from this 7-yard USS "T-1" Steel bucket used by DeLauter Coal Company in Ohio.

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
National Tube—Pittsburgh
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
**United States Steel**

# Where heavyweights move job records prove...

# FIRESTONE TOUGHNESS PAYS OFF BIG!

Extra toughness: you get it in the cord, in the rubber . . . in every inch of Firestone off-the-highway tires. And it pays off big! Helps keep equipment on the job; helps keep jobs on schedule. Behind Firestone toughness are such exclusives as (1) Firestone Rubber-X, longest-wearing rubber ever used in Firestone tires and (2) Firestone Shock-Fortified nylon cord for top protection against impact damage. Through Firestone's Giant Tire Service, an expert will match tires to your job, and handle all tire maintenance. Just contact your Firestone Dealer or Store. Or write: Manager, Off-The-Highway Tires, The Firestone Tire & Rubber Co., Akron, Ohio.

**ALWAYS SPECIFY FIRESTONE TIRES WHEN ORDERING NEW EQUIPMENT**

Super Rock Grip Wide Base* Super Rock Grip Deep Tread*

**TUBELESS OR TUBED**

**Firestone**

***BETTER RUBBER FROM START TO FINISH***

Copyright 1960, The Firestone Tire & Rubber Co.
*Firestone T.M.

# Now "trade" dead weight for payload..and haul 40% faster!

**Heap-load the big-target Payhauler body** in minimum time. Strong rock-ribbed corrugations absorb shock—resist wear and distortion. Choose the "95" with power-shift Torque-Converter, or 9-speed air-shift transmission.

**New strength-multiplying** corrugated body design results in payload-gaining weight reduction of both International Payhauler models. New "95" capacity is increased to 27 tons—and the new "65" becomes the only 19-tonner on the market!

**Look at those exclusive, rock-ribbed body corrugations!** International applies this strength-multiplying principle to reduce Payhauler® body weight by an amazing 30%! You "trade" 2½ tons of power-wasting dead weight for 3 bonus tons of payload capacity in the new 95 Payhauler!

New high-torque, high-output diesel power highballs 27-ton payloads up to 40% faster than the former "95" could haul only 24 tons! The new 375 hp DT-817 International diesel engine gives the new 95 Payhauler the wallop of 40 extra turbocharged "horses."

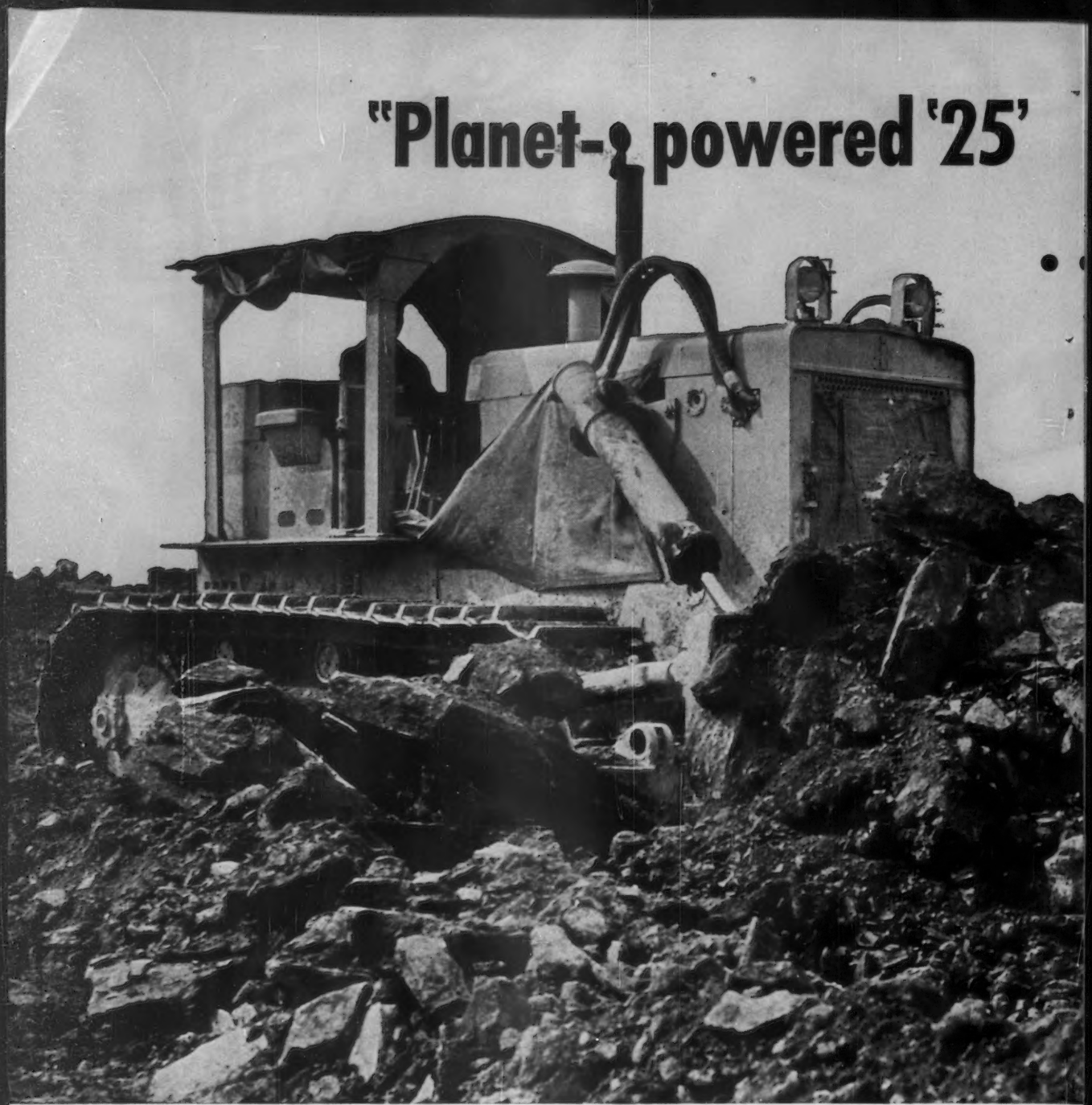
**Prove to yourself** that top load-carrying capacity plus top power-to-weight ratio give 95 Payhaulers tremendous profit-earning advantages. Add up other big Payhauler exclusives: fast reverse, up to 7.1 mph. for spotting speed; big-target bodies for loading zip; 11-second inverted-hoist dumping; load speeding safety of torqmatic braking and positive power-steering! Let your International Construction Equipment Distributor demonstrate!

**International® Construction Equipment**

**International Harvester Co., 180 N. Michigan Ave., Chicago 1**

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

# "Planet-powered '25"



**"Our International TD-25's turbocharged engine** doesn't seem to lug down under load," states Charles Skelton, superintendent for Mulzer Brothers, Tell City, Indiana. "This power, combined with planetary steering and Hi-Lo power shifting gets full loads fast and speeds-up load delivery stripping overburden."

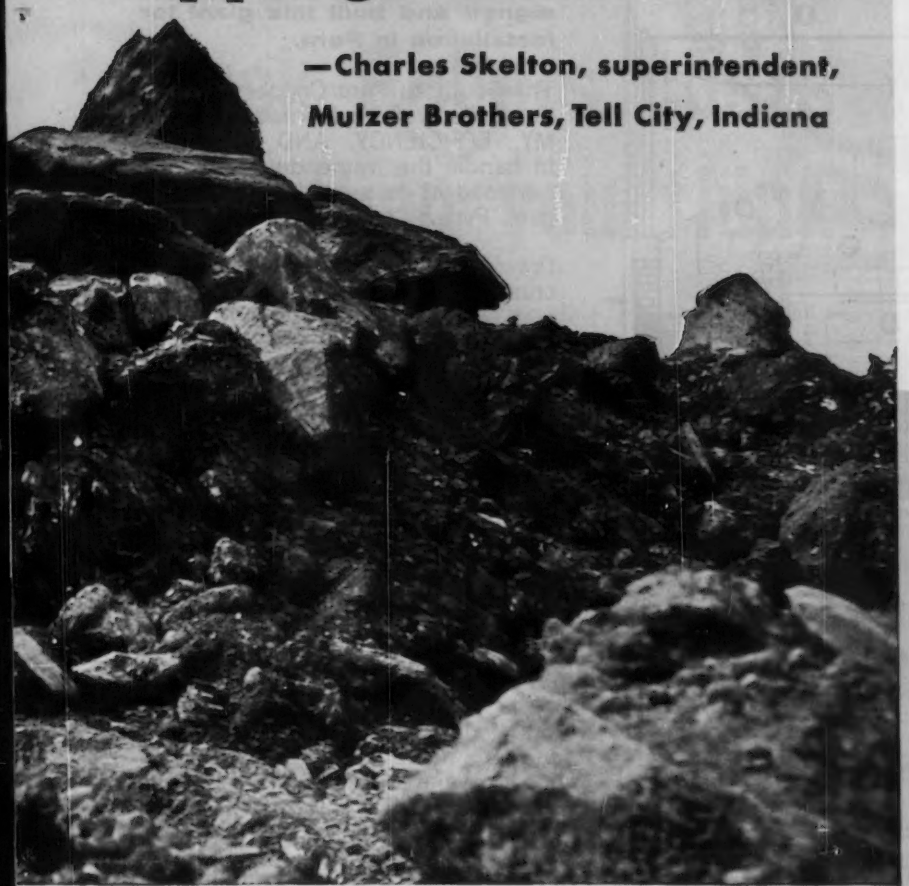
That's another way of saying that the "25," working three shifts daily on this coal-stripping operation, gives operating efficiency a big boost! They're stripping 30-foot overburden to get at a 42-inch coal seam: one-third earth; two-thirds shale, slate, and rock. The "25" takes off the top third—pushing full blade loads an average of 100 feet. A 6-yd. dragline removes the rest.

**How a "25" outblades other rigs up to 50%**—You 'doze straight ahead with heavy offset loads—you make full-load, full-power turns—where giant clutch-steered rigs slip, slue, and spill the load. Exclusive TD-25 "live track" Planet Power-steering eliminates load-limiting "dead-track drag."

With exclusive Hi-Lo, on-the-go power-shifting, the "25" gives you instant, all-the-way matching of power to condition. You roll up big loads in a hurry—and

# gets full loads fast . speeds up delivery, stripping overburden"

**—Charles Skelton, superintendent, Mulzer Brothers, Tell City, Indiana**



**Stripping overburden three shifts daily,** Mulzer Brothers' TD-25 blades full loads, an average of 100 ft. Planet Power-steering and Hi-Lo power-shifting keep full loads on the move full time. On benching or highwalling, simply operate the bank-side track in high speed range, while keeping the outside track in low range—for full-bite, full-blade performance.

**Here's your 76-page cost and production estimating book—** newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, anywhere! See your International Construction Equipment Distributor!

keep 'em rolling fast. And with exclusive International DT-817 Diesel engine wallop, the "25" bulls along, 230 turbocharged hp strong—without "slow-motion" lug-downs, even at high altitudes!

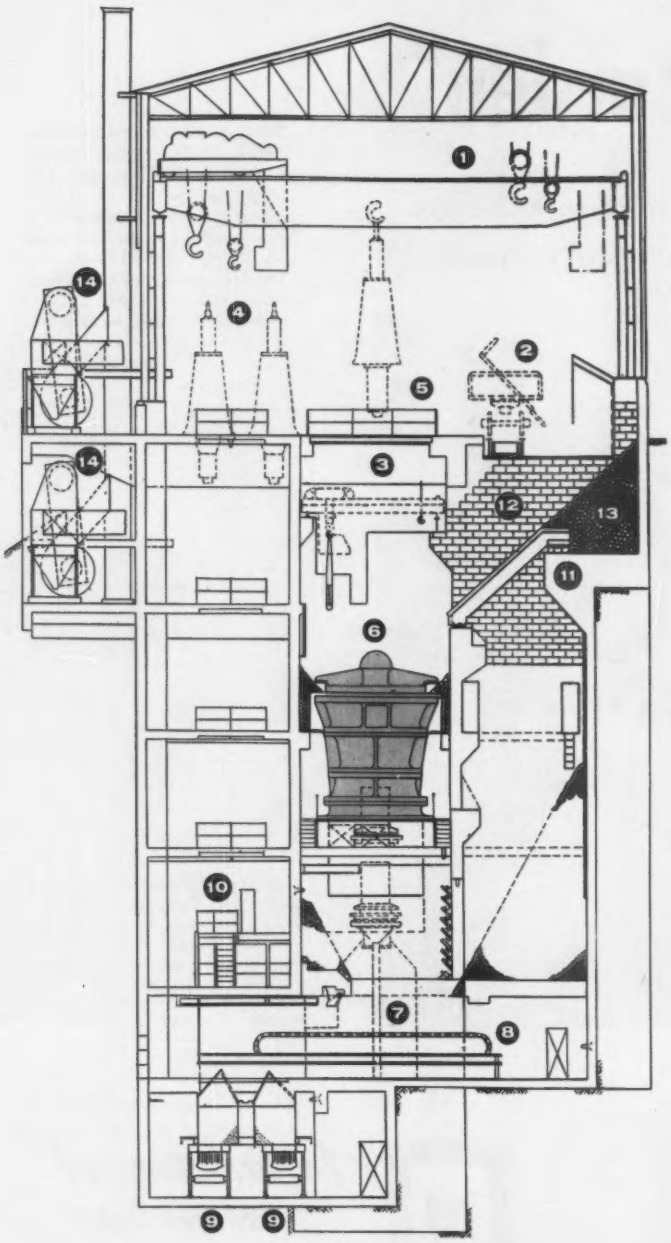
**Press the direct-start button**—power-shift and power-steer the planet-powered TD-25 with full-king-size loads—around curves, upgrade, anywhere. Prove what it means to command full-time, full-load ability to outwork and outearn king-sized clutch-steered crawlers—up to 50%! See your International Construction Equipment Distributor for a demonstration!

*International® Construction Equipment*

**International Harvester Co.,**
**180 North Michigan Ave., Chicago 1, Ill.**
**A COMPLETE POWER PACKAGE**

# 1,000,000

## POUNDS OF TRAYLOR ENGINEERING!




## TRAYLOR

**world's largest manufacturer of 60" gyratory crushers designed and built this giant for installation in Peru.**

The Southern Peru Copper Corporation called on Traylor-made ECONOMY, EFFICIENCY, AND CAPACITY to handle the tremendous crushing workload at its new plant in Toquepala, Peru.

Drawing shows Traylor 60" gyratory crusher operation:

1. 100-ton crane with 25-ton auxiliary hook and operator's cab
2. 43-cu. yd. side-dump mine car
3. 20-ton crane with rock hook
4. Mantle storage
5. 18 x 22-ft. removable hatch
6. 60-in. Traylor gyratory primary crusher
7. Hydraulic hoist, 14-ft. lift, 25-ton capacity
8. Two 72-in. pan feeders
9. Two 54-in. chain-belt conveyors
10. Electrical control panel
11. 8-in. grizzly
12. 2-in. plate liners
13. Dead-bed areas
14. Air filter dust removal unit

Other Traylor Crushers made for primary, secondary or fine reductions. Write today outlining your crushing requirements and let Traylor's engineers make recommendations . . . or ask for Bulletin No. 1126.

TCA-9

**TRAYLOR ENGINEERING & MANUFACTURING**
**DIVISION OF FULLER COMPANY**
1553 MILL ST., ALLENTOWN, PA.
Sales Offices: New York, Chicago, San Francisco
Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.

SPECIAL REPORT TO CATERPILLAR OWNERS:

CAT CATERPILLAR

Parts you can trust
... cost less per hour

# Converting to Lifetime Lubricated Track Rollers costs less than you think

**Lifetime Lubricated Roller Groups,** including seals, shafts and end collars, *cost only a little more* than ordinary Bellows Seal Rollers without end collars. But this small expense of *initial* installation rapidly disappears through noticeably lower owning and operating costs.

**Based on savings from seal replacement alone,** Lifetime Lubricated Rollers soon make up the difference. The metal rings of the Floating Ring Seal can be used over and over again. Take a 14-roller D8. At every roller rebuild, you probably have to buy 28 bellows seals @ $3.97* each or a total of $111.16. Compare this with the rubber "O" rings costing a total of only $45.08*. You save $66.08 in seal replacement costs every time you rebuild or replace. Similar savings are available on all models. And, replacement Lifetime Lubricated Roller and shaft assemblies without end collars are priced below those of Cat Bellows Seal Rollers.

**But your savings don't end here!** Here are other benefits you get from Lifetime Lubricated Track Rollers:

**1. Longer Lived Roller Shells and Component Parts.** The Lifetime Lubricated Roller is much stronger and has more metal in the wear zones, specially hardened for extra resistance to wear. And bushings, bearings and shafts are larger and stronger and will last longer. These components are *always* bathed in *clean*, heat-dissipating oil (not grease). Dirt just can't get in to accelerate wear—oil can't get out, thanks to the patented Floating Ring Seal. This means you won't be buying as many replacement bushings and shafts at rebuild or roller replacement time.

**2. Maintenance Is Eliminated.** Lifetime Lubricated Rollers need no servicing until they're finally rebuilt. You don't have to spend any time nor money for lubrication during the rollers' lives.

**3. Easier Installation.** Snap-on rings hold seals and end collars in place *before* mounting. End collar bolt holes line up easily with track roller frame holes at installation. Your tractors will be on the go much sooner.

See your Caterpillar Dealer. He'll give you the complete facts on the economy of investing in Lifetime Lubricated Rollers ... for *all* Caterpillar track-type equipment.

Caterpillar Tractor Co., General Offices, Peoria, Illinois, U. S. A.

*Suggested consumer prices for these Caterpillar parts

**SERVICE TIP:** Lifetime Lubricated Rollers need no servicing. But when rebuild time finally comes, keep metal rings matched in original pairs.

**CATERPILLAR**

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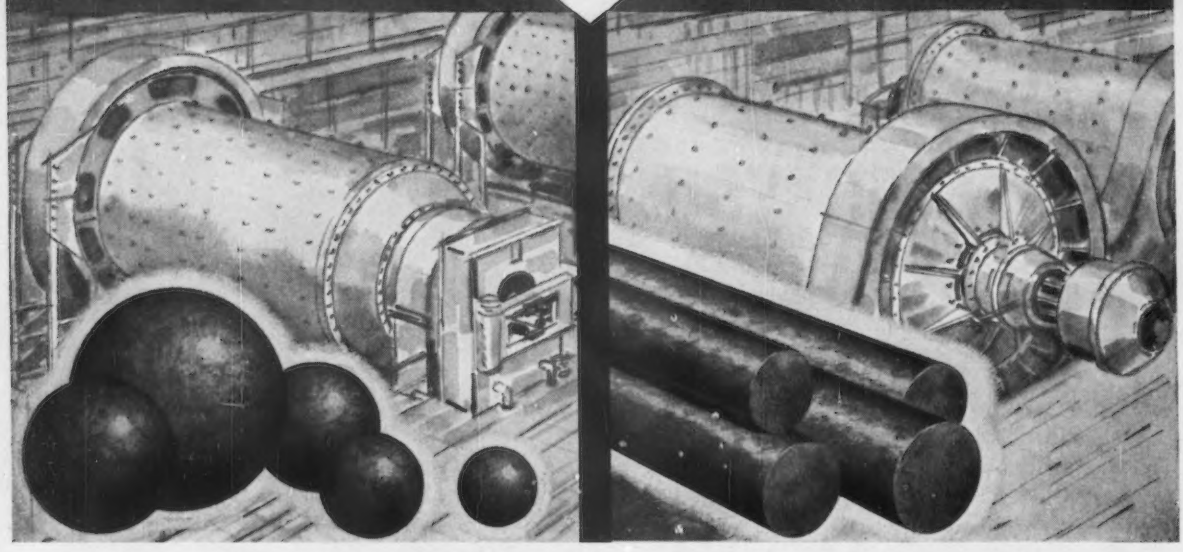
# *Total grinding costs are lower with CF&I grinding balls and rods*



Grinding Balls and Rods have a direct bearing on major grinding costs — mill throughput and power consumption. The use of CF&I Grinding Balls and Rods will actually increase your mill throughput, lowering power consumption per ton of material ground. This is a result of the microstructure of the high quality steel made and used by CF&I.

CF&I Grinding Balls have the balance of hardness and toughness that provides proper wear and impact resistance. In addition, their excellent abrasion resistance permits them to wear evenly and retain their original shape.

CF&I Grinding Rods—through controlled mill chemistry techniques — have excellent wearing properties, resisting bending and premature breakage.

All these factors contribute to more efficient grinding, higher throughput... lower grinding costs. For the complete story on the advantages of CF&I Grinding Balls and Rods, contact your local CF&I sales office.

**Other CF&I Steel Products for The Mining Industry**

CF&I Industrial Screens • CF&I-Wickwire Rope • CF&I Grader Blades
CF&I Mine Rail and Accessories • CF&I Rock Bolts and Realock Metallic Fabric

CF&I STEEL

**MINING PRODUCTS**

**THE COLORADO FUEL AND IRON CORPORATION**

7693-REV.

*In the West:* **THE COLORADO FUEL AND IRON CORPORATION** — Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Leandro • Seattle • Spokane • Wichita
*In the East:* **WICKWIRE SPENCER STEEL DIVISION** — Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia

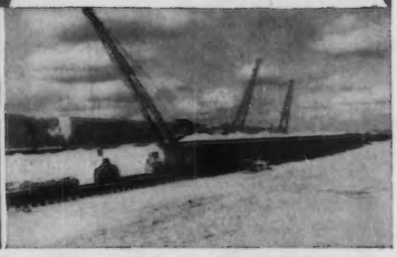
# SULPHUR

## 6 POINTS OF DEPARTURE

FANNETT, TEXAS

MOSS BLUFF, TEXAS

NEWGULF, TEXAS



SPINDLETOP, TEXAS

WORLAND, WYOMING

OKOTOKS, ALBERTA

*Solid or Molten Sulphur to all users in the United States and Canada*

In addition to these six producing properties, stocking and distribution centers are being set up, thus broadening the TGS Service to industry. Ample supplies of both molten and solid sulphur will be available at these centers. Cincinnati, the first of these units, is now in full operation.

**TEXAS GULF SULPHUR COMPANY**

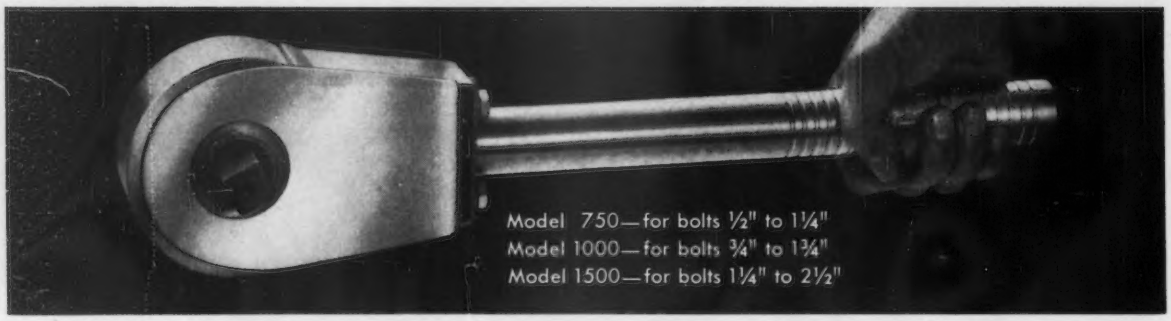
75 East 45th St., New York 17, N. Y.
811 Rusk Ave., Houston 2, Texas

*Sulphur Producing Units:* Newgulf, Texas • Spindletop, Texas • Moss Bluff, Texas • Fannett, Texas • Worland, Wyoming • Okotoks, Alberta, Canada

designed to solve a universal maintenance problem . . .

# first manual impact wrench that works . . .
# LOOSENS THE TOUGH NUTS
# EVEN POWER WRENCHES CAN'T BUDGE!

# SWENCH®




**• Loosens "frozen" nuts in seconds • Tightens nuts to maximum practical tightness**

There's never been anything like Swench before. It is an entirely new concept in wrench design. Swench is the world's *only manual impact wrench.* Here's what Swench means to you . . .

**NEW SPEED**—Nuts that previously had to be burned off can now be "Swenched off"—with unbelievable ease—by *one* man—in a matter of minutes.

**NEW EASE**—Only Swench in its torque class is truly portable . . . lets you take the wrench to the job—*anywhere*—with no auxiliary equipment, no power connections.

**NEW SAFETY**—With Swench there's no back-breaking, knuckle-knocking struggle . . . no dangerous handle extensions . . . no sudden release of a frozen nut . . . no shock transmitted through the handle.

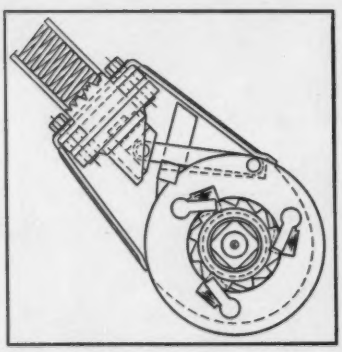
**See for yourself!** Swench is so different from anything you've experienced, you'll have to see it in action to believe it. For a quick and convincing demonstration, contact Marquette.

**NEW POWER**—Swench, size for size, gives greater—and more effective—torque than power wrenches . . . multiplies torque applied to handle over 1500% (yet all Swench's power is built into the wrench itself).

**NEW ECONOMY**—Swench saves in *many* ways . . . no auxiliary equipment to maintain and man, no costly upkeep on the wrench, no man-hours fighting frozen nuts—*and* Swench costs less than half as much as wrenches with comparable impact power.

**NEW VERSATILITY**—*One* Swench can handle more bolt sizes than any power wrench . . . loosening or tightening requires no special adjustments.

**NEW TENSIONING ACCURACY**—Precise tightening is assured with Swench, following simple instructions.



**INSIDE STORY**—How is all this possible? Unlike power wrenches that deliver many tap-like blows, or ordinary manual wrenches that apply steady torque, Swench builds up power in its super-strong spring for a mighty wallop that is released as torsional impact every time the handle is advanced slightly more than 30 degrees.

*Write for further information.*

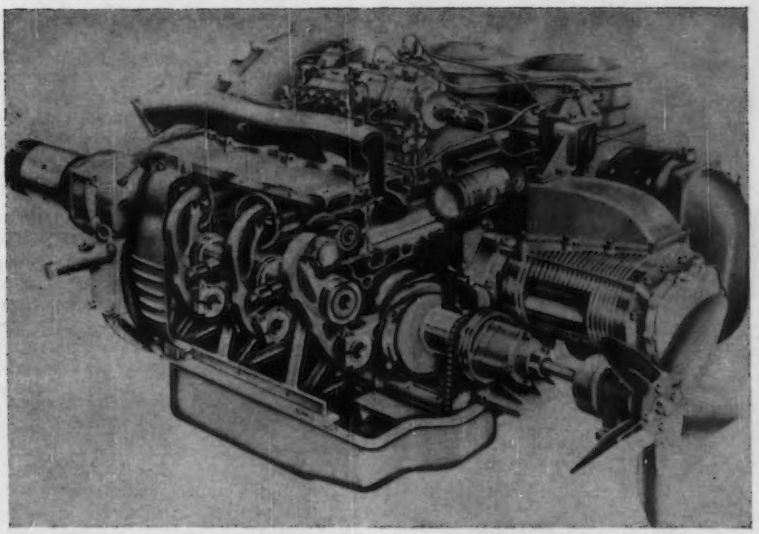
*"When you're up against the tough nuts . . .*
**Don't wrench it . . . SWENCH it!"**

**MARQUETTE DIVISION**

# CURTISS WRIGHT

**CORPORATION • 1145 GALEWOOD DRIVE, CLEVELAND 10, OHIO**

# NEW PRODUCTS DIGEST



## Rootes' Engine Runs on Almost Anything (12)

A REVOLUTIONARY NEW ENGINE which runs on high or low test gasoline, diesel oil, kerosene, jet fuels or even cleaning fluid is being introduced to the U.S. by England's Rootes Motors.

According to Rootes, the main significance of the new engine is that it will allow utilization of the most economical kind of fuel available in any given area. The multi-fuel feature is particularly important when vehicles or machines are being used in remote areas.

The basic two cycle, three cylinder unit is designed to deliver 105 brake hp —variations in design allow 75 and 85 hp ratings as well.

## Nozzle Heads (14)

ESTIMATED 250% INCREASE in service life plus more complete soot removal has resulted from the use of high alloy shell-molded nozzle heads in a new soot blower design for stationary and marine high temperature boilers. According to the manufacturer, Blaw-Knox Co., Copes-Vulcan Div., the nozzle heads are used in long retractable soot blowers that are rapidly replacing fixed units for tube cleaning operations.

"The nozzle assembly is welded to the end of a lance which sprays jets of high-velocity steam or air through the nozzles, as the lance simultaneously rotates and extends or retracts within the boiler. Because the jets release more mass at higher velocity and this results in more energy, better cleaning is accomplished with the long retractable soot blower. When blowing operations are completed, the lance and nozzle assembly are retracted from the corrosive heat zone and into a protective sleeve in the boiler wall or roof."

## Vibrating Mill (20)

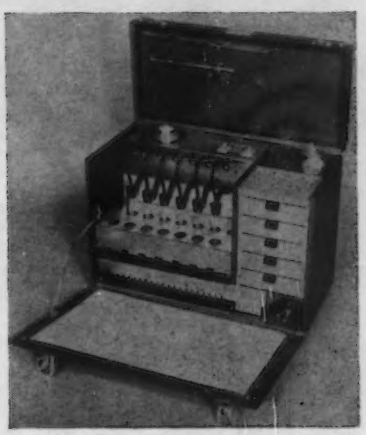
A 30-IN. VIBRATING MILL suitable for continuous processing of a wide range of materials has been introduced by Allis-Chalmers to supplement the 15-in. mill developed in 1958.

A-C's new mill is powered by two 50-hp motors and can outproduce a tumbling mill 15 to 30 times per unit volume. The company also said that the initial cost of the vibrating mill is at least one-third lower than that of any other of comparable capacity.

## Safety Clothing (6)

NEW TYPE of asbestos safety clothing that will shed molten metal at 3,000° F without deterioration, loss of resiliency or discoloration of inner side has been announced by American Optical Co. The specially woven fabric, called Thermogarb, offers 40 to 50% greater abrasion resistance than ordinary asbestos and has nearly double the tensile strength of fabrics twice its weight and thickness, according to the manufacturer.

In addition to these features, garments of Thermogarb asbestos reflect approximately 50% of radiant heat, and are extremely light in weight. For comparative purposes, the maker states that a 30-in. long coat made of the cloth weighs 3¾-lb compared to 6½-lb for the conventional asbestos coat.



## Pollution Tester (15)

COMPACT PORTABLE APPARATUS for air pollution testing in emergency or preliminary field work is now available from Central Scientific Co.

The detector uses a colorimeter to estimate amounts of eight gaseous pollutants and can also be used to indicate the presence of 10 particulate pollutants. Quick tests are made possible by a train of reagents and color solutions through which the air is pumped. The color developed in each solution is a direct measure of the pollutant deposited. The colors developed by the unknown air sample in the solutions are compared against color standards which have been previously calibrated in terms of micrograms of pollutants per cu ft.

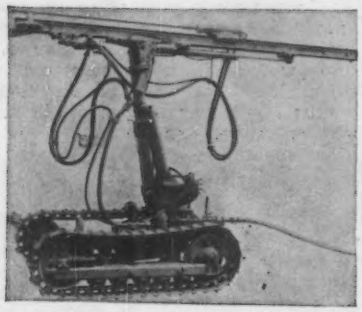
## Oil Additive (7)

ORONITE CHEMICAL CO., after extensive field and laboratory tests, is now marketing a specialized detergent fuel oil additive which, it reports, will greatly boost the life of diesel injector systems. The firm labels the product OFA 265 and claims that it's the only detergent additive ever developed specifically for diesel fuels. It is a mixture of ash-free organic surface active compounds blended to provide protection from gums and rust on injection system parts.

During one of the company tests, three tank trucks operated on diesel fuel compounded with OFA 265 for mileages ranging from 109,000 to 165,000 miles.

The remaining 12 trucks in the fleet, all equipped with the same type of engine, used uncompounded fuel.

OFA 265 boosted injector life by 63% with average replacement interval increasing to 70,000 miles. In addition, injectors operating on fuel containing OFA 265 produced a smoke level equivalent to that of clean, reconditioned injector for distances up to 50,000 to 69,000 miles.



## Drilling Rig (17)

CHICAGO PNEUMATIC has introduced the all-new G-900 Tracdril and calls it the most advanced crawler-mounted drilling unit on the market. It is the only mechanized drilling rig capable of drilling over either track at right angles—can cover a 17-ft dia 180° arc.

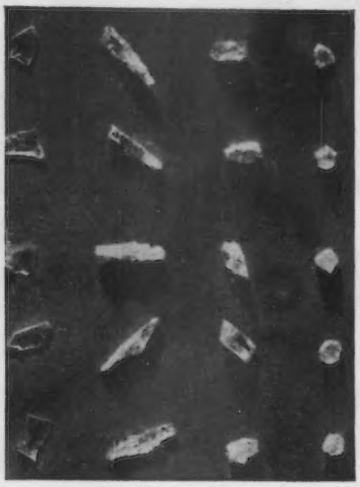
Tracdril's boom can drill horizontal snake-holes 25 in. from the ground, but can also be raised to a height of 11 ft for horizontal breast-holes. Carriage dump adjusts through a full 360°, increasing top-hole reach, and the 85° carriage swing allows vertical drill holes regardless of slope conditions.

Chicago Pneumatic went on to say that the Tracdril can spot quickly and effortlessly. All drilling maneuvers (swing, lift, dump and tilt) are hydraulically controlled. Dual controls—one set on forward end of the drill boom, the other at the tramming position—provide the operator with control of every maneuver from front or rear, saving stops, increasing production.

## Rope Slings (8)

NEW SERIES of preformed wire rope slings has been introduced by the Wire Rope Sling Department, American Chain & Cable Co., Inc. The slings are designed for any application where ease of handling is all-important and offer the flexibility and non-kinking advantages of hemp rope plus the strength of steel.

American Chain's slings come in 12 different rope diameters ranging from 9/32 to 2-in. sizes, and the breaking strength ranges from 3-tons for the smallest dia to 113 tons for the 2-in. sling.



## Diamond Grit (19)

INDUSTRIAL DIAMOND DIV., Engelhard Hanovia, Inc. is introducing a new and highly improved natural diamond grit for special applications. Designated "Selected Natural Diamond" ("SND"), the new material differs significantly in particle shape from conventional diamond grit and is reported to dramatically increase grinding efficiency of resinoid wheels.

Unlike conventional diamond grit, SND consists mainly of needle-shaped and plate-shaped particles. Needle particles are those which are at least twice as long as they are wide and plates are those which are less than one quarter as thick as they are wide. By contrast, conventional grit contains particles of generally blocky proportions.

SND-type particles, Engelhard said, because of their shape, are held much more firmly in the bond of a resinoid bond grinding wheel, a major advantage under certain operating conditions. Another advantage stemming from the shape is that the particles are more friable and tend to break off a little at a time, continually exposing sharp new cutting edges to the workpiece.

(Top right rows consist of the cubic and oblong particles which predominate in conventional natural diamond grit; third row is SND needle-shaped; left row is SND plate-shaped.)

## Vacuum Filter (5)

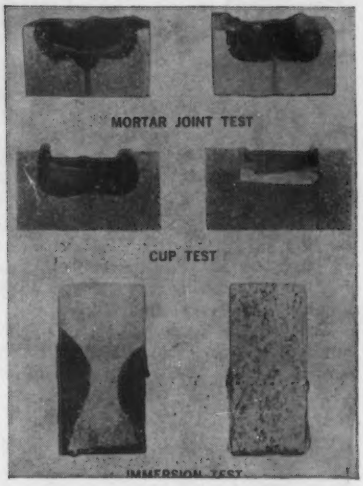
AN IMPORTANT DEVELOPMENT in industrial filtration—successful washing of the filter medium during continuous operation—has been applied to the new EimcoBelt vacuum filters, according to Eimco Corp.'s Filter Div.

EimcoBelt filter washing principle eliminates blinding of the filter medium even when handling the most difficult slurries. According to the company, the EimcoBelt is even being used to filter glutinous materials and slurries containing low density solids which vacuum filters previously have not been able to handle.

## Refractory Brick (10)

TO SOLVE THE PROBLEMS that stem from the severe conditions of aluminum melting furnaces, Harbison-Walker Refractories Co. has developed two unique brick refractories and a high-alumina mortar.

H-W said that these products were subjected to extensive laboratory tests over many months before they were introduced and put into commercial production. Reports on service performance




show that they are easing the destructive impact accompanying furnace charging, retarding excessive corrosion of the furnace parts and most largely avoid contaminants which in minute amounts are undesirable.

Alumina in stabilized crystalline form is the main constituent of the refractory brick. The brick, called Coral, in its several modifications for specific conditions, is phosphate-bonded, chemically, or hard-fired with the phosphate bond or made with a ceramic bond developed by high temperature firing.

## Crane-Excavator (18)

A COMPLETELY NEW air-controlled crane-excavator in the 3½-4½ cu yd size has

been announced by American Hoist & Derrick Co.

The new machine, when rigged as a lifting crane, has a rated capacity of 110 tons. All booms are alloy steel with tubular lattice construction and with pin connecting sections. The 3½ yd single stick rope crowd shovel attachment has a high shipper shaft,—great floor cleanup area and excellent reach. The backhoe is available in either 55 in. or 65 in. bare bucket cutting width with the positive-pressure attachment as an optional extra.

American Hoist & Derrick believes that, for its size, the 900 series is the easiest and quickest to prepare for transport.

### Electrical Operators (47)

A NEW LINE of electrical operators that allows Type AB circuit breakers to be remotely controlled is now available from Westinghouse Electric Corp.

Models with rated control voltages of 120, 240, 480 or 600 volts ac and 125 volts dc can be supplied. They will actuate breakers rated to 100 amps at 600 volts in frame sizes designated E, EH and F.

Breakers that are mounted on panel boards, switchboards or bus-duct plug-in units can be equipped with the new electrical operators. For easy installation, operator mounting holes are identical in spacing and size to those for the breakers in all of the three available frame sizes. For back mounting, a special pin can be supplied.

### Compressor Casing (48)

A NEW SIZE cast iron scroll type casing has been added to the standard single stage centrifugal compressor line by Allis-Chalmers Mfg. Co. The casing expands the volume range available for the 6.0 psig pressure level when using direct connected 3,600 rpm electric motors.

The new scroll casing is available in either direction of rotation and is designed to provide air volumes from 15,000 to 35,000 cfm.

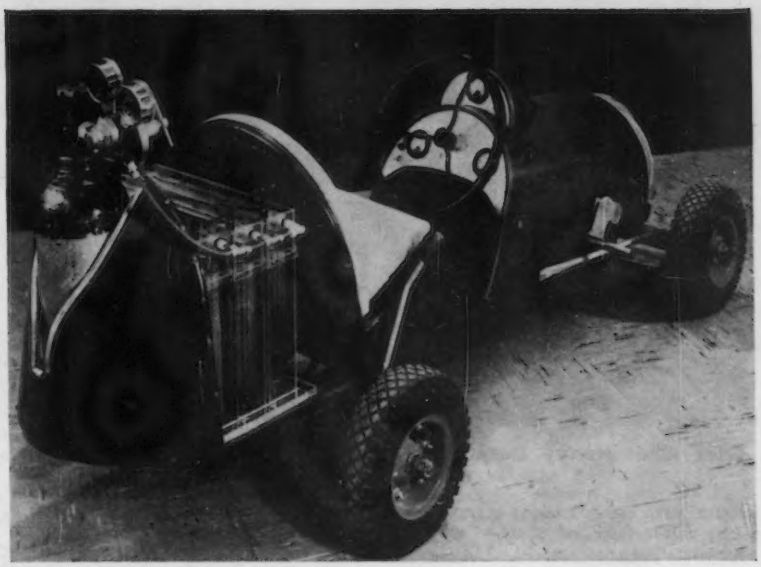
### End Trucks (49)

HOIST & CRANE DIV. of Robbins & Meyers, Inc. has introduced its new line of crane end trucks and accessories designed for users who wish to assemble their own overhead traveling cranes. All necessary components except the structural steel bridge and the drive shaft are supplied.

The new line offers 18 ratings for spans to 50 ft—load capacities range from one to 10 tons.

Both light duty and heavy duty models are available. Light duty models are motor-driven and are offered in either top-running or underhung construction. They are powered by a head-mounted motor on each end truck. The heavy duty models are motor-driven top-running and hand-geared top-running.

A line of torque arm center assemblies is available for heavy duty motor-driven designs. Other available accessories include magnetic controls, current collectors, and cross shaft bearings and couplings.



### Exide Continues Research into Fuel Cell (91)

EXIDE INDUSTRIAL DIV., Electric Storage Battery Co., has signed agreements with 12 of the nation's material handling equipment manufacturers to jointly develop an adaptation of the Exide fuel cell to power electric industrial trucks.

The company is already beyond the basic and applied research stages in the development of at least one type of fuel, a rechargeable zinc-oxygen unit that's a forerunner of other cells, and believes that within a few years it can develop practical, mass-produced cells that will be several times more powerful per cu ft than any fuel cells so far demonstrated.

By using zinc as the fuel—compressed oxygen as the exidizer—Exide has produced a cell of great simplicity and of unusual design that is strikingly different from most previously announced models which use gaseous fuels. Here are some of the advantages: Operation at nearly normal temperatures and pressures; no waste products to be removed; ability to be scaled up or down in size and electrical capacity for a wide power range. (photo shows a prototype cell installed into a racer)

### Air Sampler (50)

A SIMPLIFIED AIR SAMPLING DEVICE, small enough to be held in one hand, has been perfected by the Du Pont Industrial Hygiene Lab.

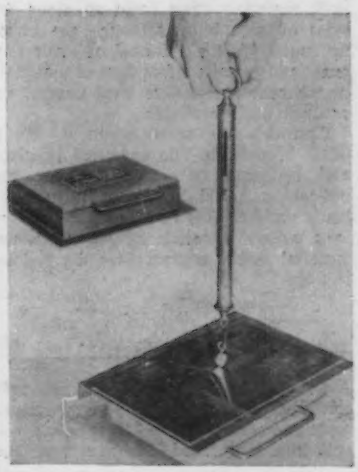
Weighing less than 4 lb, the new device contains a miniature jet engine powered by a can of low-pressure liquified gas. Other than an "instant action" control valve, the unit has no moving parts.

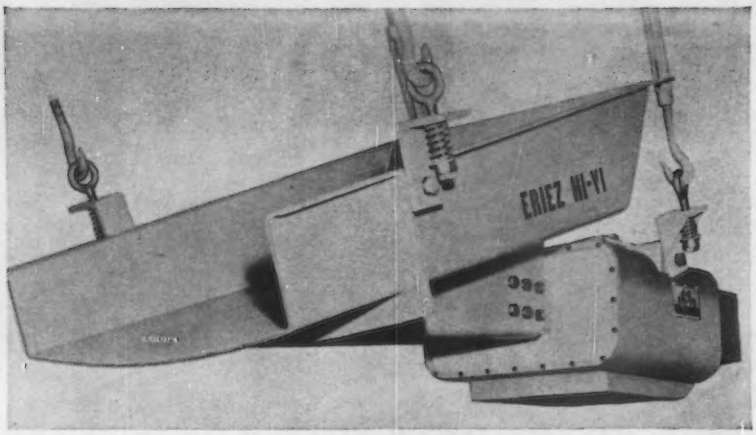
### Plate Magnet (9)

ERIEZ MFG. CO. recently introduced a completely new line of plate magnets which they say promises to be the answer to many common but stubborn problems involving all types of tramp iron and fine iron contamination.

At one demonstration, a one-in. dia steel ball, presenting an actual contact surface little larger than the head of a pin, required more than a 28-lb pull to free it from the face plate of one of the new magnets.

The new magnets power lies, according to Eriez, in the development of a specially designed and energized Ceramic V magnetic material (Erium 25), affording a more intense concentration of magnetic strength adjacent to the surface of the plate magnets.






## Eriez Adds Heavy Duty Unit to its HI-VI (92)

ERIEZ MFG. CO. has added a new heavy-duty unit to their line of HI-VI vibratory feeders. The new model, 75A, has a rated output of 75 tph when operating level, and is designed to handle a great diversity of materials in a wide range of particle sizes.

75A's drive elements are completely enclosed, protected against damage or decreased efficiency due to contamination by moisture and foreign materials.

Variable auto-transformer type controls vary the applied line voltage, permitting quick, accurate adjustment from zero to the optimum feed rate for specific materials and uses.

## Chain Wrenches (41)

TWO NEW chain wrenches just introduced by the Ridge Tool Co. are designed especially for work in extra tight quarters and feature fast, ratchet-like action in either direction—from either side. The chain gives tight grip without crushing on all round, square or irregular shapes. Tempered steel link has large, easy-to-grab finger ring for fast adjustment.

Two models are presently available. No. C-14 handles up to 2-in. pipe and fittings; No. C-18 up to 2½-in. pipe and fittings.

## Level Indicator (42)

CONVAIR OF PITTSBURGH has developed a series of level indicators which they say will solve a major problem for companies using large bulk bins for storage. Bulk materials often build up along the sides of such bins. Although the build-up usually forms a funnel of static material and permits a free flow of materials in the center, it makes level control inaccurate and unreliable.

Convair's top-center-mounted Flexi-Shaft Model Bin-Vue is bolted in place and, by means of a torsion spring, the indicator's 1/100 hp motor turns a 4-blade paddle. This turns continuously as long as no material touches it. When material makes contact with the paddle, it stops.

## New Thermocouple (43)

A NEW REFRACTORY metal thermocouple combination for reliable temperature measurement up to 5,072°F is now available from Engelhard Industries, Inc. One part of the combination is tungsten while the other is tungsten 26% rhenium alloy.

The new unit, originally developed in the Rugby Research Laboratory of A.E.I. Lamp & Lighting Co. Ltd., is recommended for use at the 3632-5072°F temperature range but its high output also makes it useful at lower ranges. The combination of high melting point and low vapor pressure makes it useful in vacuums at both high and intermediate temperatures. However, the thermocouple should not be used under oxidizing conditions or in the presence of hydrocarbon vapors—these will attack tungsten at temperatures above 1,000°C.

## Unloading Valve (44)

COMPLETELY ADJUSTABLE unloading valve which automatically diverts full pump flow to a reservoir when system pressure reaches a pre-set point has been developed by Fluid Controls, Inc.

The valve is used in accumulator and hi-lo circuits or for venting large relief valves, and offers the following unique features: 1) A 5% to 20% adjustable differential between load and unload pressures for better system efficiency; 2) A sliding spool that will not stop half way—assures complete loading and unloading.

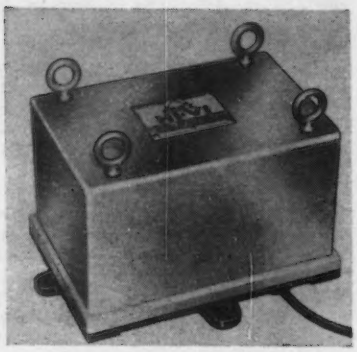
In addition, the valves has a built-in check valve and an internal pilot that eliminates extra piping.

## Fan-Cooled Drives (45)

NEW LINE OF FAN-COOLED DRIVES (Radicon Worm Gear Reducers), introduced by Foote Bros. Gear & Machine Corp., combine unlimited flexibility of mounting with high efficiency radiation and convention cooling to provide right angle power transmission that meets virtually any requirement in the range up to 66 hp.

Foote said that the Radicon Reducers are made in 12 sizes with center distances from 1⅛ in. to 8 in., with input capacities from .01 to 66 hp. They incorporate the involute helicoid tooth which permits highest load carrying capacity and efficiency together with long service life and quiet operation. Gear and bearing lubrication is positive in either rotation direction and is fully automatic at all operating speeds.

Radicon Reducers are offered in adaptable and fixed-base series models. All adaptable Radicons are fitted with "dry-well covers on the output shaft, which prevents the leakage of oil into the shaft bearings when the shaft is positioned vertically downward.



## Bin Vibrator (16)

ERIEZ MFG. CO. has introduced the largest unit in their line of Bin Vibrators. The new model 60U is an "in line action" type for installation on bin walls of approximately ⅜-in. thickness and of 20 ton capacity. The concentrated vibratory action is, according to Eriez, more independent of objects in operation over a wider range of service conditions.

## Truck Analyzer (46)

AN "ELECTRONIC BRAIN" that analyses truck performance in a fraction of the time normally required by field tests is helping truck engineers design more efficient vehicles, according to C. V. Crockett, chief engineer of General Motor's Truck & Coach Div.

Mr. Crockett said the machine, a medium-sized digital computer, can chart the progress of a hypothetic truck over a prescribed route, calculating its trip time, average speed, fuel usage and other factors with astonishing accuracy.

"In a matter of minutes without actually building the truck," Crockett explained, "we now can gather performance facts that would take us months of field work to compile. This permits us to sort out the most likely components from the 'improbables' and concentrate outfield testing in areas that seem most promising."

From cards, machine digests information on truck features and route's road conditions and staff can trace vehicle's mile-by-mile progress.

# For Your Files

**This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.**

**SPECIFICATION-CRAMMED** 40-page catalog describing over 100 complete thermocouple assemblies in detail has just been released by Minneapolis - Honeywell Regulator Co.'s Industrial Div.

The section on general purpose assemblies covers straight, angle, high-speed small O.D., spring-loaded high-speed, and new high-temperature assemblies. **(80)**

**NEW CHART** designed to simplify the selection of hose and hose ends has just been published by the Weatherhead Co., Fort Wayne. **(81)**

**DUST FILTER** with only three moving parts, the "RJ" made by the Day Co., is said to give a highly efficient, automatic-continuous, low cost operation and is described in the company's bulletin G-30. **(99)**

**THEW SHOVEL CO.** has just prepared a two-color, 20-page catalog on their ¾-yd, crawler mounted Lorain Model 26. Bulletin No. 26751-0 gives details of machine's construction and job applications for use as shovel, crane, clamshell, dragline and hoe. **(51)**

**G-A DOUBLE CUSHION** check valves that prevent damaging hammer and shock caused by back surge are described in a four-page bulletin (WS-1A) from Golden-Anderson Valve Specialty Co. **(52)**

**ALL OF THE ADVANTAGES** and varied applications of four types of Jeffrey mechanical vibrating conveyors are described in an elaborate 63-page catalog (954). The Jeffrey Mfg. Co. vibrating conveyors (HMV-heavy, TMV-twin mass, MMV—medium, and LMV—light) are presented in photos and cross-sectional views—all with extensive specification charts. **(53)**

**TRACK CLEANER** which increases safety, cuts production loss, and eliminates derailment and ditch cleaning, has been developed by American Mine Door Co. The unit, called the "Canton," is described in an eight-page booklet. **(54)**

**FLOTATION REAGENTS,** Mineral Dressing Notes No. 25 has just been revised by American Cyanamid Co. It was last put out in 1954—the 48-page booklet now contains facts about new Cyanamid flocculants as well as information about copper-lead and copper-moly separations. **(56)**

**HOW THE POWER SHIFT** transmission, lifetime lubricated rollers and other advanced features of the D9 and D8 tractors boost production and save time and money for their owners is told in an eight-page, two-color booklet (booklet D018, "The Men Who Know") just released by Caterpillar Tractor Co. **(57)**

**McLANAHAN & STONE CORP.** has developed a new line of revolving scrubbers for handling product sizes up to 8 in. The scrubbers are in three sizes: 6x12 ft, for 60-120 tph capacities; 7x14 ft, for 90-180 tph capacities; and 8x14 ft, for 125-250 tph capacities. All are presented in the company's bulletin HDS-70. **(55)**

**CONDENSED CATALOG** for lubricating equipment (X-135), prepared by Oil-Rite Corp., offers drawings, specification tables and descriptive paragraphs on a complete line of oil cups, oiling systems, dispensers, valves and flow indicators, oil gages, and chain oilers. **(58)**

**P-K PAUL** control valves of unique Venturi-ball design are described in a new 16-page catalog (GV-101) from General Kinetics Corp. The catalog presents engineering, specification and purchasing information on the complete line of cast, barstock and special valves, which are supplied in sizes from ¼ in. to 14 in., for pressures from high vacuum to 50,000 psi, and temperatures from —425°F to 1800°F. **(59)**

**LATEST DATA** on the physical properties of cryogenic gases is now available in both wallet size and full-sheet size cards from Air Products Inc. Information includes boiling points, critical points, triple points, specific heats and densities of most gases ranging from Acetylene to Xenon. Data on Nitrogen Trifluoride is supplied for the first time. **(60)**

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**ENGINEERING & MINING JOURNAL**
**330 WEST 42nd STREET**
**NEW YORK 36, N. Y.**

**E&MJ** NOT GOOD AFTER JAN. 1, 1961 **JULY 1960**

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| 3 | 13 | 23 | 33 | 43 | 53 |
| 4 | 14 | 24 | 34 | 44 | 54 |
| 5 | 15 | 25 | 35 | 45 | 55 |
| 6 | 16 | 26 | 36 | 46 | 56 |
| 7 | 17 | 27 | 37 | 47 | 57 |
| 8 | 18 | 28 | 38 | 48 | 58 |
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**ONE OF THE MOST COMPLETE** catalogs of safety work gloves ever compiled has just been made available by the Advance Glove Mfg. Co. **(61)**

**WILLIAM R. BRADLEY** and associates, consultants on air pollution, water pollution, radioactivity, noise and toxicology, have recently issued a four-page leaflet describing the organization's background and illustrating the scope of operations with a few case histories. **(63)**

**A NEW 8-PAGE BOOKLET** "Motor Selector," has just been released by Howell Electric Motors Co.

It lists in brief, easy-to-use arrangement, a quick reference to the complete motor and generator lines available through the consolidation of Howell with Ohio Electric Mfg. Co., Kingston-Conley Inc. and Leland Ohio Electric Co. **(64)**

**A 56-PAGE** presentation dealing with Sterling A C Multi-Shielded motors is, according to Sterling Electric Motors Inc., one of the most comprehensive motor catalogs ever issued. It includes complete pricing and dimensional data on motors ranging from ¼ to 200 hp. The catalog also shows various modifications, such as specialized mountings and enclosures, as well as the new STERLICONE Multi-Shielded drip-proof motors. **(67)**

**ALLIS-CHALMERS'** Construction Machinery Div. has just published literature on two of their tractor loaders. One piece, MS-1373, features the TL-14 model. It's an eight-page catalog that contains information on the two transmissions available for the 83 hp unit, a bucket selection chart and complete specifications.

The other piece, MS-1386, is a specifications sheet covering the recently-introduced TL-12 tractor loader. **(69)**

**TWO-COLOR,** four-page leaflet describing the new Union Bonnet Bronze Gate Valve, Fig. 3125, has been prepared by the Lunkenheimer Co. Fig. 3125 is available in ¼- to 2-in. sizes, has a double wedge disk and rising stem and is rated 125 lb S.P.—200 lb W.O.G. **(65)**

**KITS** to reproduce any conceivable burn, cut or fracture for ultra-realistic first-aid demonstrations are being assembled by Alderson Research Laboratories Inc.

Alderson feels that no amount of films or lecture can teach proper procedures for giving first-aid to severely injured people. During times of emergency, inexperience can often lead to death.

In addition to making kits that reproduce wounds of all types, Alderson markets a compact model, called Respertrain, to help teach proper artificial respiration techniques. **(74)**

**MERCER RUBBER CO.'S** complete line of rubber hose for air, water, steam, acid, acetylene welding, and many other applications is described in 24-page, two-color catalog.

A section of the catalog deals with hose fittings—17 different types. A chart, "How to Select the Right Coupling," is provided for quick reference. Other sections are devoted to prolonging hose life and how to attach hose fittings and couplings. **(75)**

**A NEW** and complete line of production-built power steering components that can be combined to suit virtually any steering axle load requirement is described in the 17-page brochure M-5110 released by Vickers Inc., Div. of Sperry Rand Corp. **(76)**

**D4 TRACTOR** that incorporates a new diesel engine and a lifetime lubricated undercarriage is described by Caterpillar Tractor Co. in a new 12-page booklet.

The Cat diesel engine is listed with 65 hp at the flywheel and 25% more lugging ability. It incorporates a dry-type air cleaner that needs no oil. Another tractor feature is an operator's compartment that's been completely restyled for convenience, comfort and safety. **(77)**

**UDYLITE CORP.** presents technical data on eight standard side cleaning models of their U/D Series "60" filters in a four-page brochure. The company said that maintenance and cleaning of the 200 to 10,000 gal per hr filters is greatly aided by the side opening operation. **(68)**

**PENNSYLVANIA** Crusher Div., Bath Iron Works Corp., describes its new "Hercules" Single Roll Crusher in bulletin 2020. **(82)**

**KENNEDY VAN SAUN'S** full line of heavy-duty, dual-rotor impact breakers is covered in a new eight-page, two-color brochure (No. 60-A). These machines are built to handle non-abrasive quarry rock and similar materials and to produce a high proportion of cubical product at high reduction ratios and lost cost. **(71)**


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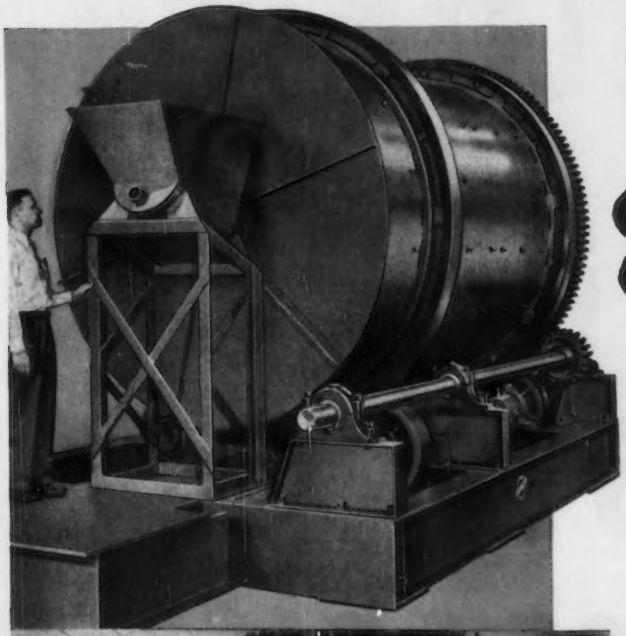
## FOR CLEAN ORE—HIGH CAPACITY

# TELSMITH

# Super-Scrubbers®



● **high speed...terrific impact...grinding action much like a ball mill.** Ore travels from feed to discharge end against clean water flowing in the opposite direction —emerges clean—with clay and dirt disintegrated and carried away by the water.

**low cost installation, operation and up-keep.** Economical of water and power. The Telsmith Super-Scrubber is made in four sizes: 60-inch to 96-inch; with capacities of 50 to 250 tons per hour. Send for descriptive Bulletin 266.

**Philippine Islands**—this mill of **Baguio Gold Mining Company** is equipped with a 60-inch Telsmith Super Scrubber.

●

**Minnesota**—in the custom mill of **Skubic Bros.**, Virginia, Minn., a 96-inch Telsmith Super Scrubber turns out remarkably clean ore at minimum cost.

Min. 38

## SMITH ENGINEERING WORKS

**502 E. CAPITOL DRIVE** **MILWAUKEE 1, WISCONSIN**

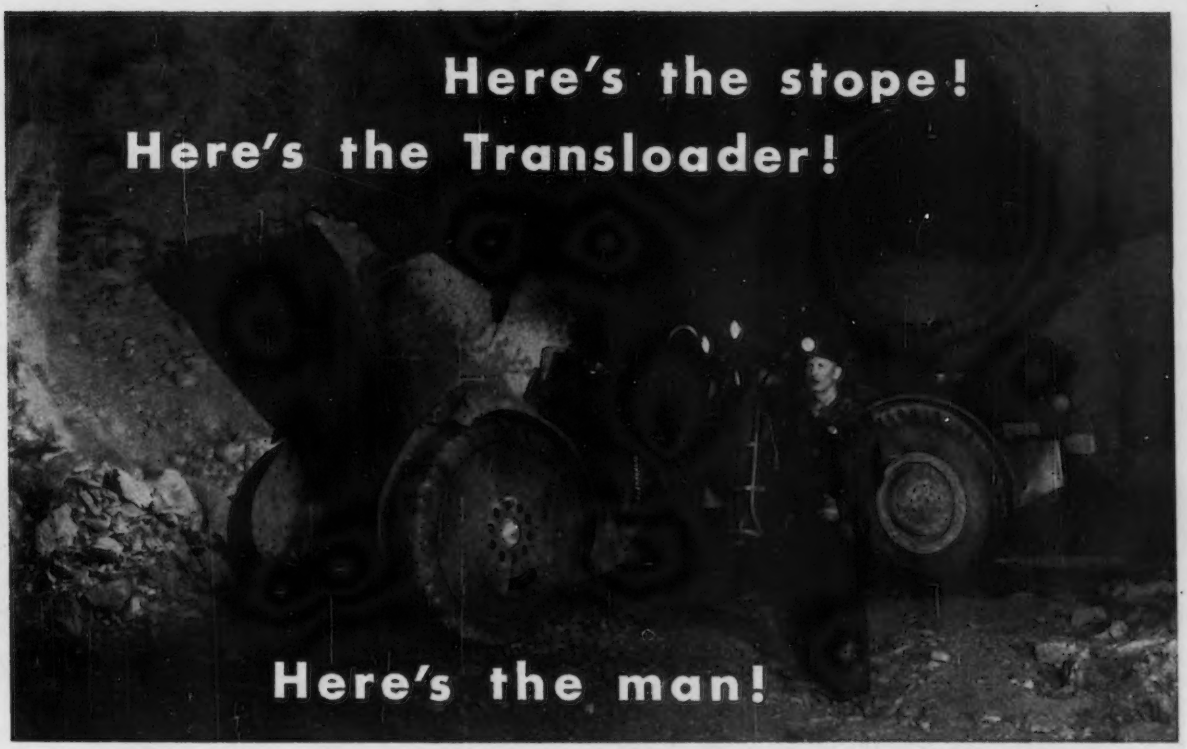
**Representatives in Principal Cities in All Parts of the World** • **Cable Address: Sangworks, Milwaukee**

*It is difficult to believe—but the truth is...*

# This S-D TRANSLOADER LOADED, HAULED and DUMPED 1,045 TONS in one shift!

**THIS WAS NO TEST nor demonstration. This customer and user was backstoping. Several thousand tons had been shot. S-D Transloader operator Robert White was simply loading, hauling, and dumping as usual with his self-loading transport. The one way tram to dump hole was 150 feet. (S-D Transloader also operates more effectively and more efficiently than conventional equipment on long hauls.)**

**AT THE END OF THE SHIFT MR. WHITE HAD MOVED 1,045 TONS OF HARD ROCK! That was 190 loads! On the following night shift he loaded 180 times for 990 tons. He moved 2,035 tons in two consecutive night shifts!**

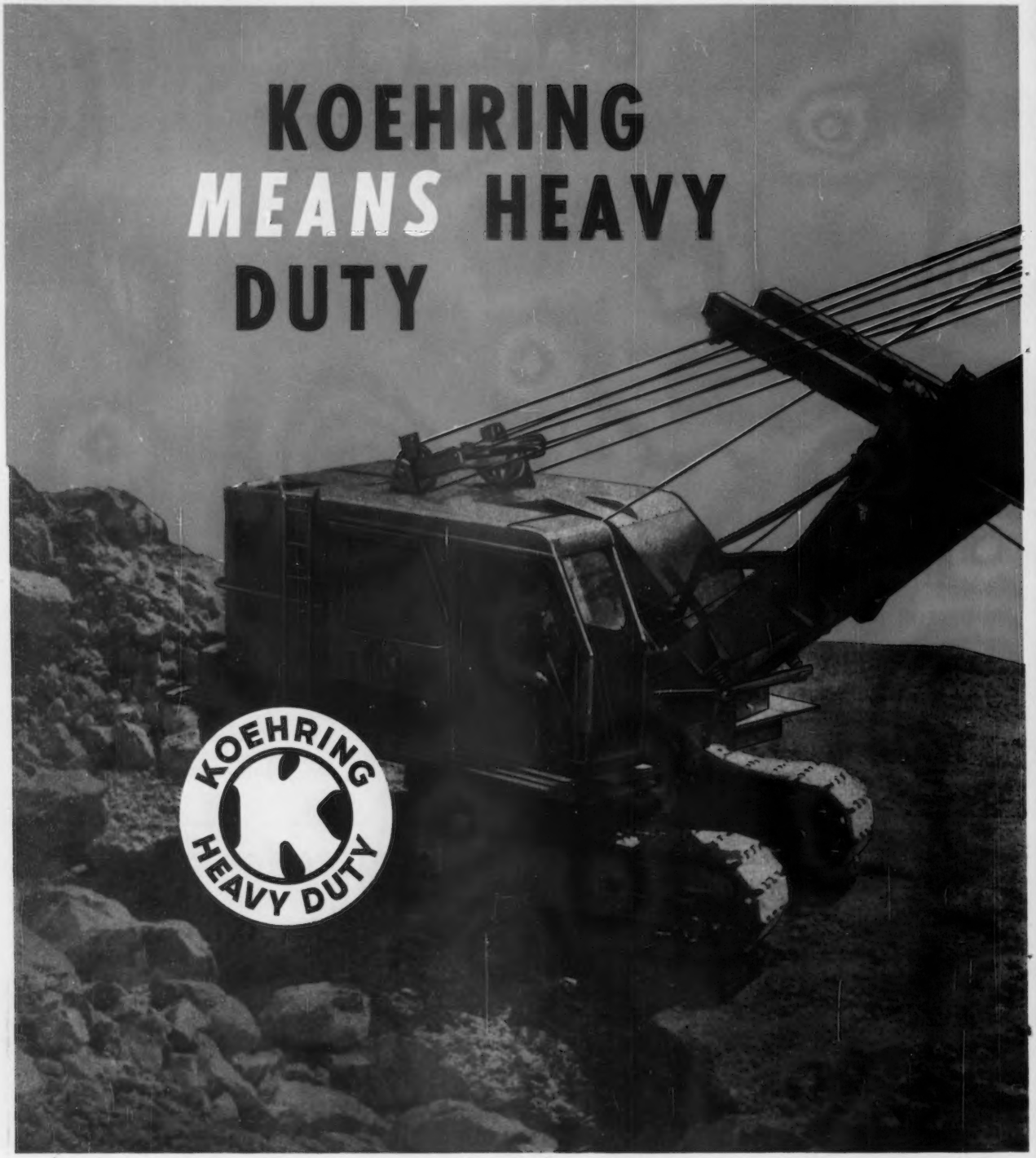



**THE FACTS ARE, FURTHER, that the S-D Transloader requires (1) the *lowest* original cost for tons handled . . . (2) *lowest* maintenance, due principally to extremely simple design . . . (3) *least* ventilation due to low horsepower to work done . . . and (4) *lowest* labor cost per ton!**

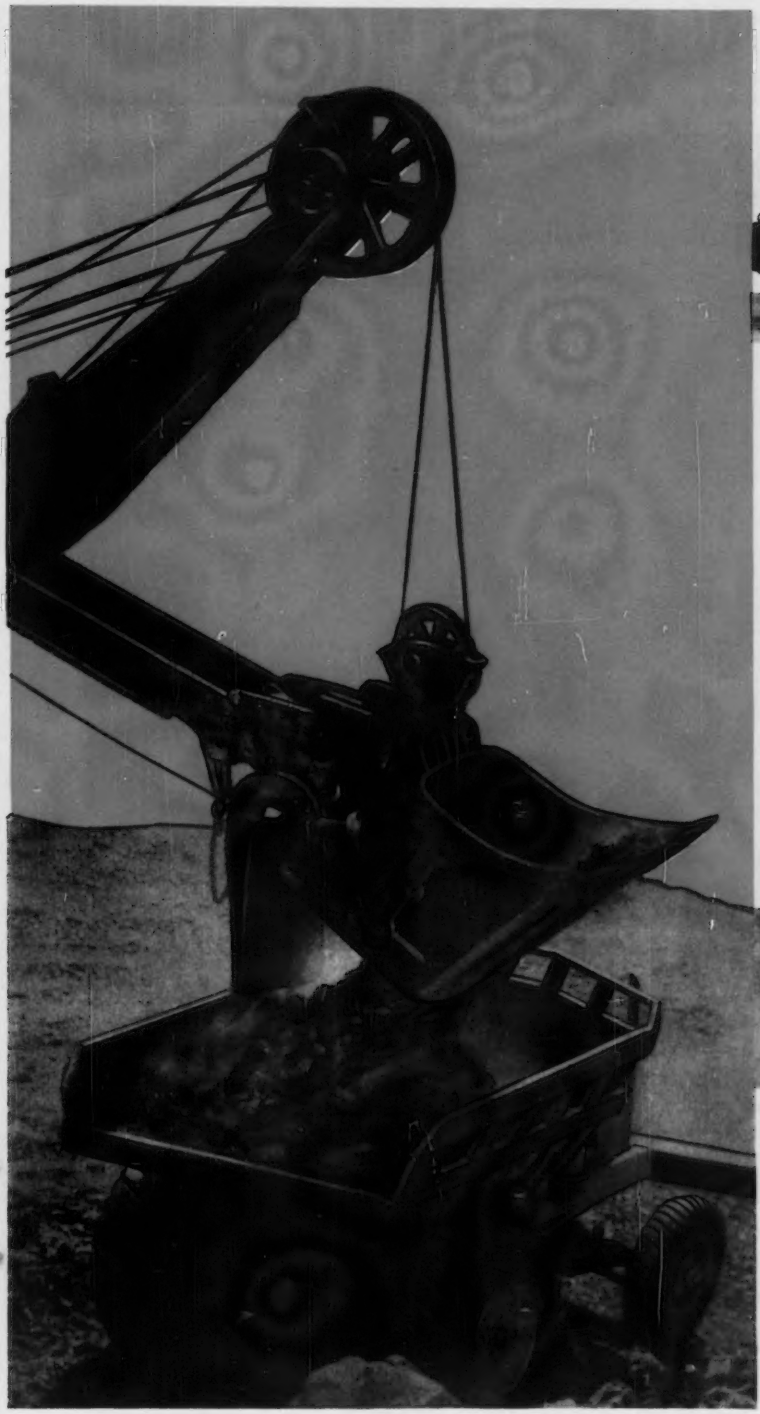
**The performances of many S-D Transloaders in several mines justify *your immediate* investigation! The Transloader is doing a job you cannot afford to overlook! Call us — today . . . 3-4191. Wire or write:**
***Sanford-Day Iron Works, Inc., Dale Avenue, Knoxville, Tennessee, U.S.A.***

**WE WILL BE AT LAS VEGAS . . . with the S-D Transloader! At our Sanford-Day BOOTH 43, in addition to the Transloader, you will be able to view documentary movies showing exactly what the Transloader is doing *in action* underground to increase production at tremendous reduction in cost! We invite you to visit with us at BOOTH "43" . . . American Mining Congress, MINING SHOW, Las Vegas, Nevada, Monday-through-Thursday, October 10-13, 1960.**

**SANFORD-DAY**
**KNOXVILLE, TENNESSEE**




The words "HEAVY DUTY" are an important part of the Koehring trademark . . . have been for years. And there's a mighty good reason. Koehring machines have proved through millions of hours of service that you can count on them to outproduce and outlast other makes under the most severe conditions. When you buy a Koehring, you buy heavy duty performance that puts you yards ahead for years and years. See your Koehring distributor soon.



. . . heavy duty digging

Koehring shovels give you real heavy duty dependability. Take the business end — you get big tough rock boom, double dipper sticks, rugged chain crowd and long wearing dipper. Take the crawlers—each shoe is strong enough to support the entire machine plus its rated load. Take the main machinery — shafts are kept in perfect alignment because side stands are line bored in place.

. . . heavy duty hauling

Koehring Dumptors® combine heavy duty ruggedness with quick no-turn, off-road hauling. They give you pivoting seat, dual controls for full speed hauling in both directions. All welded, multiple ribbed body with rock guards — stationary or free swinging kick-out pan — delivers heavy duty performance toughest jobs demand. Haul with a heavy duty Dumptor for bigger payload profits. 8 and 15-ton capacities.

*More work capacity . . . more profit per dollar invested*

KOEHRING
DIVISION OF KOEHRING COMPANY
Milwaukee 16, Wisconsin

K17

# GET REAL PRODUCTIVITY—GET A GM DIESEL ENGINE

Like to cut your fuel costs and save over two thousand dollars per overhaul?

That's what is being done by R. P. Waldie, General Manager of Rocky Mountain Mining and Transport Company, uranium ore haulers in Grants, New Mexico.

Here's what he has to say about this Diamond T, eighth GM Diesel powered unit to be added to his fleet.

"GM Diesel engines cost us less to operate and average less time in the shop than any other power plant we have in the fleet. We're averaging 5.5 m.p.g. with this unit compared to 4.5 m.p.g. on our trucks that are powered with another make Diesel."

Rocky Mountain Mining and Transport hauls uranium ore from mine to mill. They operate at an altitude of 6200 feet . . . haul up to 60,000 lbs. GCW over tough grades in temperatures as low as 14° below zero.

When it comes to overhaul costs Mr. Waldie says, "We're getting an additional 60,000 to 100,000 miles between overhauls on our GM Diesel powered rigs. Also, we figure it costs us about $1500 to do a major on a GM Diesel and about $3700 on the other make. We save on operating and overhaul costs and get more time on the road."

You'll find your productivity and profits climbing, too, if you put GM Diesels to work for you. See your GM Diesel distributor, or write direct for more information.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

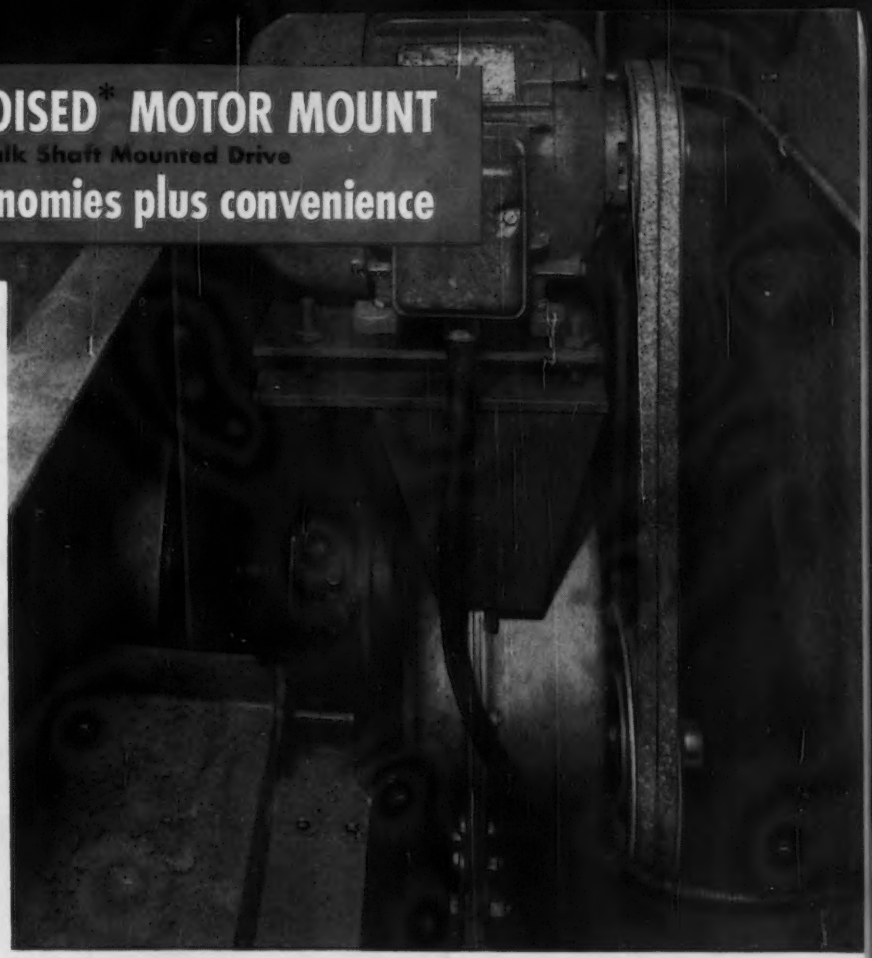
In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

## GM DIESEL ALL-PURPOSE POWER LINE sets the standard of Diesel productivity

# NEW FALK EQUI-POISED* MOTOR MOUNT

for use with the Falk Shaft Mounted Drive

## gives unequaled economies plus convenience

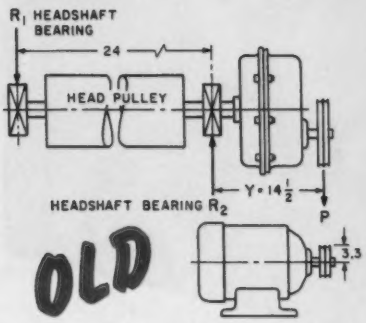


### HOW A FALK EQUI-POISED MOTOR MOUNT REDUCES BEARING LOADS ON A DRIVEN MACHINE

**GIVEN:** Motor—15 hp, 1750 rpm, Frame 284U, Weight—320 lb.
Sheave diameters—6.6/9.4
Driven machine—belt conveyor with 24″ center distance between headshaft bearings.

**NOTE:** Weights of 307J24 Shaft Mounted Drive, sheaves, and V-belts are eliminated from calculations because they remain constant; do not affect the comparison.

### WITHOUT FALK MOTOR MOUNT




Torque at motor shaft = $\frac{63{,}025 \times 15 \text{ hp}}{1750 \text{ rpm}} = 540$ lb-in.

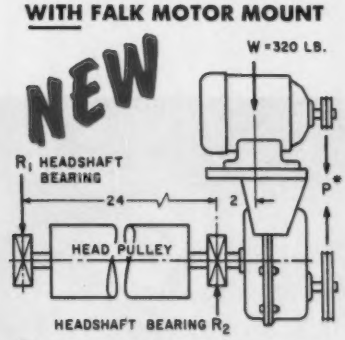
Belt pull (P) = $\frac{540 \text{ lb-in.}}{3.3''} \times 1.5$ Load Connection Factor
= 246 lb

$R_2 = \frac{246 \text{ lb} \times (24'' + 14.5'')}{24''} = 395$ lb

$R_1 = \frac{246 \text{ lb} \times 14.5''}{24''} = 149$ lb

(Check: 395 lb—149 lb=246 lb)

### WITH FALK MOTOR MOUNT




*P = ZERO REACTION AT HEADSHAFT BEARINGS

V-belt pull has zero reaction on headshaft bearings. Therefore—

$R_2 = \frac{320 \text{ lb} \times (24'' + 2'')}{24''} = 347$ lb

$R_1 = \frac{320 \text{ lb} \times 2''}{24''} = 27$ lb

(Check: 347 lb—27 lb=320 lb)

## Falk's new EQUI-POISED* Motor Mount is a rigid, all-steel weldment, pre-drilled for bolting standard NEMA foot-mounted motor (1/2 to 30 hp) directly to the steel frame of Falk Shaft Mounted, Flange Mounted and Screw Conveyor Drives. With it, motor can be mounted in almost any position around perimeter of reducer.

*(* Balancing of forces.)*

### Substantial Savings for You

It saves engineering time required to design special motor bases and foundations...saves cost of labor and materials required to build special motor foundations...and saves on equipment costs by using a quality stock component. Further, its quick installation and easy maintenance mean added cost savings. The Motor Mount is a space saver, too. Where restricted space is a factor, ability to mount motor in any of several positions is an important convenience...For information on range of sizes, dimensions, etc., contact your Falk Representative or Distributor—or write direct for Bulletin 7100.

**THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN**

*MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS*

**FALK**

a good name in industry

**Representatives and Distributors in most principal cities**

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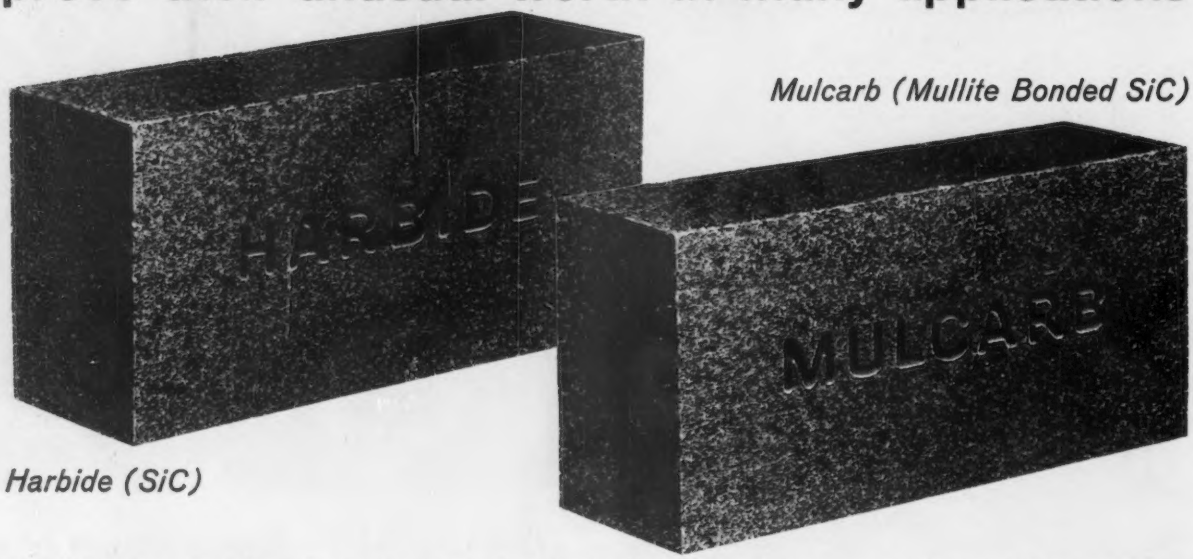
# HARBISON-WALKER
# SILICON CARBIDE REFRACTORIES
## prove their unusual worth in many applications



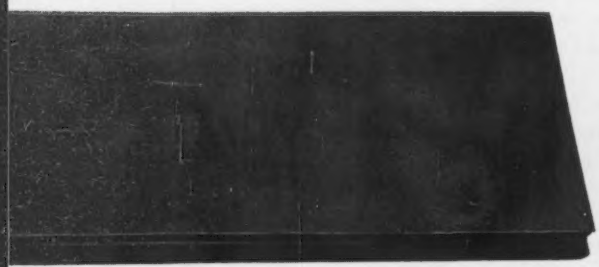

*Mulcarb (Mullite Bonded SiC)*

*Harbide (SiC)*

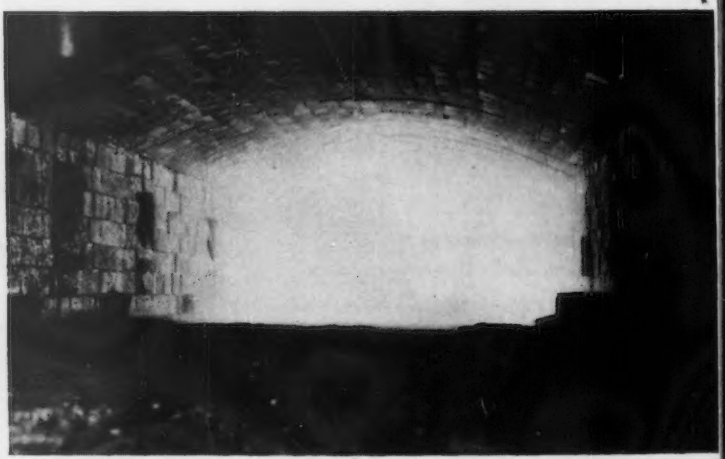
By taking advantage of particular properties of these brands and their specialized modifications for various specific uses, excellent service is regularly secured. These benefits are attributable to the singular combinations of physical and chemical properties of these silicon carbide refractories, unmatched by the many other types and classes of commercial refractories.

Physical properties possessed to the maximum degree by Harbison-Walker silicon carbide refractories make them best suited for many uses. Briefly these properties are—High Thermal Conductivity—Great Resistance to Mechanical Abrasion over a wide range of temperatures—Resistance to Various Fluxes—High Temperature Strength—Low Thermal Expansion and Low Spalling Tendency. Their increased resistance to oxidation and their volume stability under severe temperature conditions contribute further to the noteworthy achievement in the development of these Harbison-Walker brands.

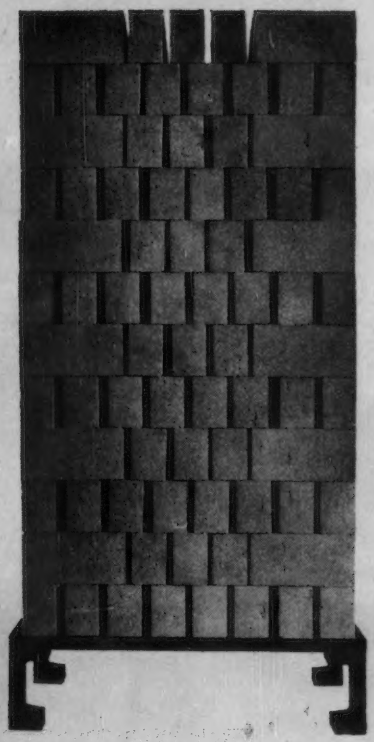
Illustrated in the following are typical uses and properties of primary importance in the accomplishment of superior results in refractory practice:



**HIGH THERMAL CONDUCTIVITY.** Large thin HARBIDE muffle tile for zinc refining furnace.



**ABRASION RESISTANCE.** HARBIDE blocks after long service in floor of heating furnace.

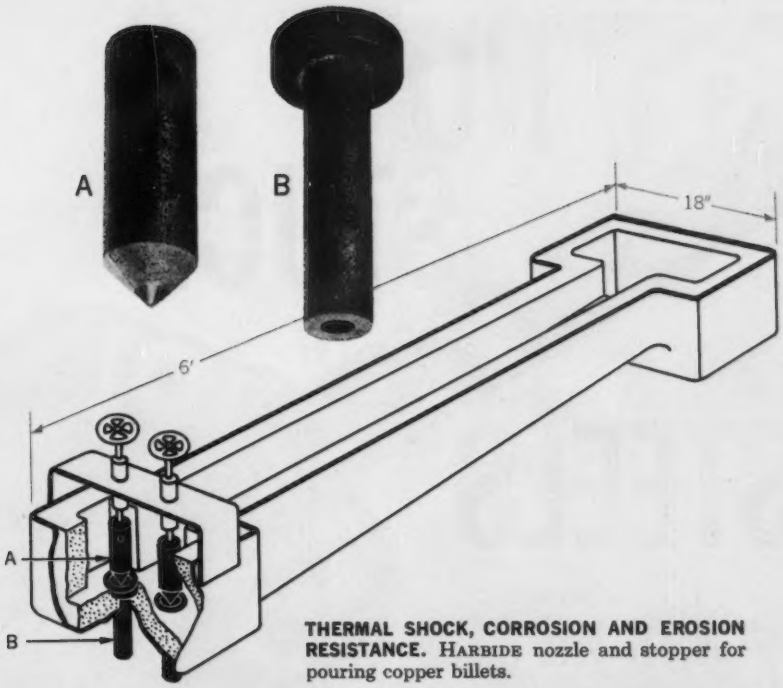


**HIGH TEMPERATURE STRENGTH.** HARBIDE setter tile and supports, with heavy brick load, fired at Cone 18 makes many trips through tunnel kiln.

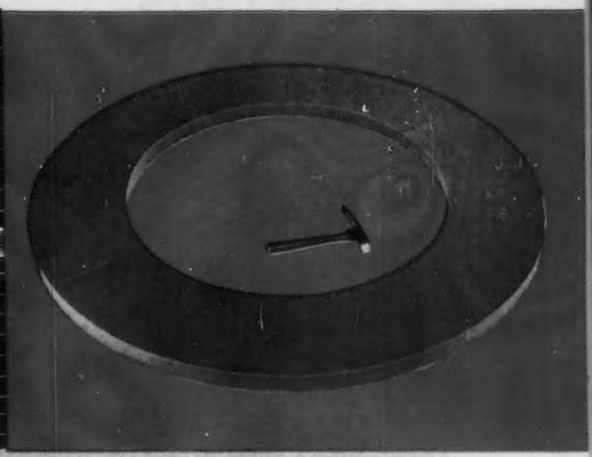
**CORROSION RESISTANCE.** Protection against burning, with advantage of high heat transfer.

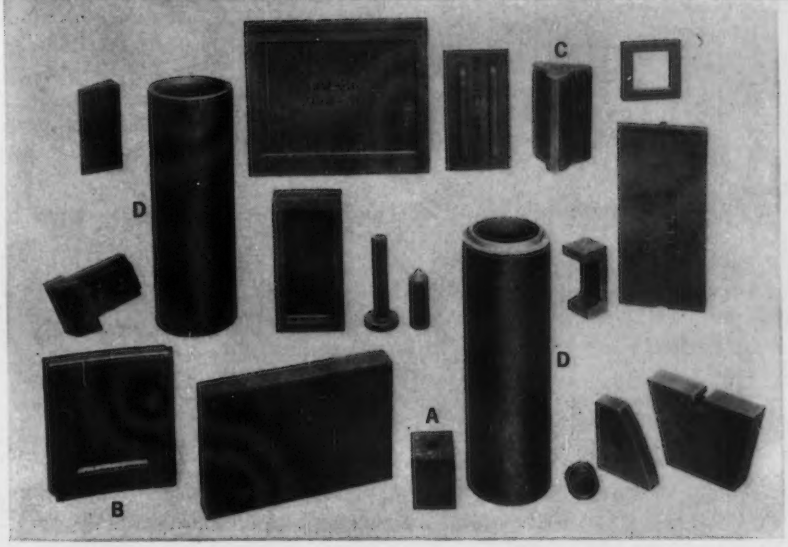
**RESISTANCE TO DUST ATTRITION.** (far right) Plate-type HARBIDE orifice for blast furnace raw gas scrubber.

**VERSATILITY.** Group of H-W silicon carbide shapes shown below, right, includes (A) tapping block (B) muffle tile (C) trefoil skid rail and (D) large tubes.




**THERMAL SHOCK, CORROSION AND EROSION RESISTANCE.** HARBIDE nozzle and stopper for pouring copper billets.






# HARBISON-WALKER REFRACTORIES COMPANY *AND SUBSIDIARIES*

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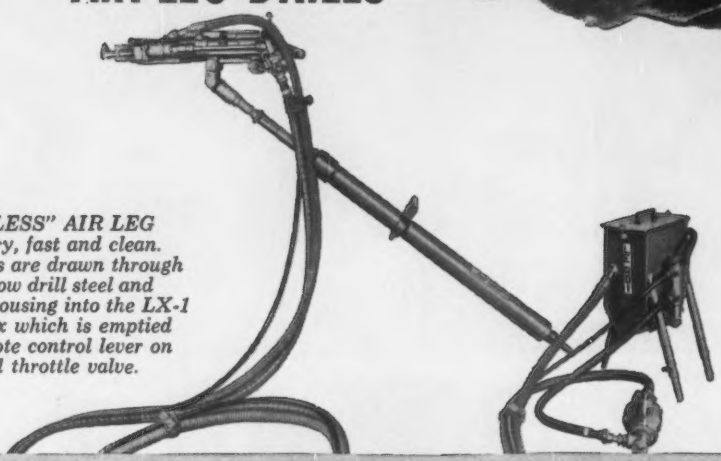
*World's Most Complete Refractories Service*

HW-60-15

# NO STUCK STEELS

## WITH THE NEW LE ROI DUSTLESS AIR LEG DRILLS



*NEW "DUSTLESS" AIR LEG drills dry, fast and clean. Cuttings are drawn through the hollow drill steel and chuck housing into the LX-1 dust box which is emptied by remote control lever on the drill throttle valve.*

*Steels never stick* when they're on the business end of the *new* Le Roi LLV Dust-Collecting Air Leg Drill. The dustless drill melts its way through the hardest rock — piles up more drilling footage with a lower dust count than was ever possible with wet drilling.

Dry, dustless drilling permits continuous ore sampling — saves every speck of precious ore. It eliminates the need and expense of water — does away with wet, dangerous conditions; sinking pillars; lost holes; water and muck haulage.

The LLV collects dust through the drill steel and exhausts it through the chuck housing — *not the machine!* It's ideal for mining or tunneling in hard rock — saves tools and operators.

Ask your Le Roi distributor for a demonstration. Or for more information, write to the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wis.

**LE ROI NEWMATIC® AIR TOOLS**

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-907

*"Imagination . . . is the source of human improvement; experience its implement"*

# NEW PROGRESS IN COPPER—BY KENNECOTT

Arizona has a new landmark, the world's most modern copper smelter. Its giant, 600 foot stack thrusts skyward from the desert at Hayden, Arizona, a dramatic symbol of progress in copper, a tribute to knowledge, advanced technologies and the vision of Kennecott Copper Corporation.

This marvel of copper production, utilizing the most advanced methods, industrial skills and equipment, promises substantial supplies of the much-needed red metal for a world of home and industrial uses

WKE—Western-Knapp Engineering Co.—designed, engineered and built the new Kennecott Smelter. Close cooperation and coordination between the men of WKE and Kennecott achieved a high degree of efficiency through every phase of development.

Should you be considering plant construction or expansion, we would like to explain how the WKE approach to modern plant development results in more plant per dollar spent.

We will be happy to send additional information on the new Kennecott Copper Smelter or other projects covering a wide range of industries—on request.

WKE®
WESTERN-KNAPP ENGINEERING CO.
SAN FRANCISCO • New York • Chicago • Hibbing
*Building for the Future — in a World of Industries*

*FOR BREAKAGE LIKE THIS ON YOUR NEXT SHOT...*

# WHICH EXPLOSIVE?

Here's really effective blasting, the kind that gets more payload service out of all your equipment. Look at the breakage—it is uniform and thorough for easy, economical handling. The point is, uniform breakage like this doesn't just happen. Whether you are blasting in underground stopes, drifts, or shafts, or in open pits, there is a combination of explosives and blasting methods that is right for every shot.

For example, in addition to the four shown here, there are other such specially developed products as Atlas Pellets, a new form of ammonium nitrate that has both the density and sensitivity needed for efficient AN-oil blasting; Giant Gelatins for high velocity, shattering action; Ammodyte,® a new economy dynamite; and Giant "75" Primers for efficient detonation of blasting agents.

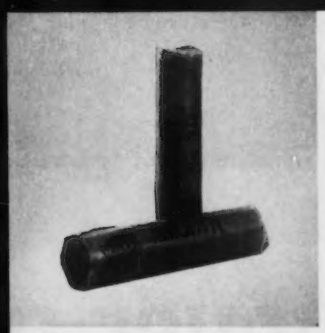
It will pay you to ask your Atlas Representative about these, and the many other products in the complete Atlas line. Working with him, you will have the advantage of his experience with the latest advances in explosives and techniques. He can help you determine the combination of explosives, blasting agents and particular blasting methods that will be the most profitable for you on every shot.

There is only one way to look at explosives costs, and that is: which explosive will give you the most payload service from all your equipment? Our blasting cost chart, slide rules and technical literature are designed to help you do exactly that. Ask your Atlas Representative about them or, write directly to:

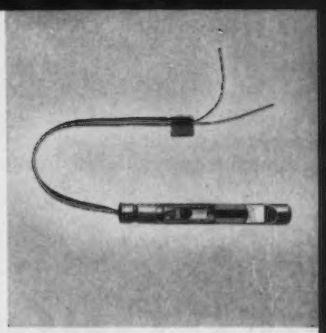
**ATLAS POWDER COMPANY**
**Explosives Division, Wilmington 99, Del.**

# ATLAS EXPLOSIVES

**When you use the right combination, all your equipment moves in sooner... works faster... produces more.**



**AMODYN,®** an ammonia type explosive, is available in both high and low velocity grades. Used mainly in stoping and tunneling.



**MANASITE®** half-second delay electric blasting caps have the most uniform timing because of exclusive Atlas electric match.

**ROCKMASTER®** millisecond delay electric blasting caps achieve the staggered action so important for better breakage and control.

**GELODYN,®** a complete series of semi-gelatins, is suitable for wet work and can be retained in upward pitching bore holes.

# WESTINGHOUSE PROGRESSIVE AUTOMATION CAN HELP YOU ACHIEVE PLANT FLEXIBILITY, INCREASED POWER EFFICIENCY FOR SMELTING AND REFINING

Changes in electrochemical processing techniques represent the major problem confronting the industry. How to utilize existing facilities when newer production processes are developed . . . and how to optimize profits from the present plant investment are other problems.

Westinghouse is ready to help you plan *economical steps* to automatic production to achieve your goals without over- or under-automating. Westinghouse Progressive Automation is an individualized plan to gain higher product quality through step-by-step control of operations . . . a long-term plan with minimum capitalization.

Rapid growth of the metal mining industry finds many electrical systems badly overloaded without adequate protection . . and narrowly limited in adaptability to changing electrical needs. D-c power requirements in the production of aluminum, copper, magnesium and other metals call for reliable and economical equipment to convert a-c power to d-c power in very large blocks. Powering-Up with an adequate electrical system is a logical first step on the road to Progressive Automation.

To provide more efficient means of supplying the large blocks of direct current, Westinghouse developed the silicon rectifier for all voltages. As compared to other types of rectifiers, the high efficiency of the Westinghouse silicon rectifiers permits power savings of $50,000 in a typical installation rated at 100,000 amps, 300 volts d-c. Recently, Westinghouse installed the world's largest silicon rectifier unit (rated 10,000 amps, 600 volts d-c) for a large aluminum producer.

Automatically regulated furnace transformers, to supply the exacting and varied current and voltage requirements in electrometallurgical and electrochemical operations, are a next step in Progressive Automation. Furnace transformers are subject to frequent short circuits which cause heavy current surges and high mechanical stresses. Westinghouse furnace transformers are designed to handle these conditions and give uninterrupted service.

For drive requirements, reliable Westinghouse motors provide efficient power. Consider the five bonus values of the new F/A Motor: fully accessible . . . inspection is faster, easier and more complete than ever before; inherently quiet . . . housing is isolated from the stator; Thermalastic® insulation . . . for long life and protection of coils; same reliable basic components; easy to connect.

* * *

Westinghouse Progressive Automation is a step-by-step plan toward gaining higher product quality. Carried to its logical conclusion, it can mean eventual coordination of all production variables under a digital computer.

Today, there is one source for all electrical equipment for the metal mining, smelting and refining industries. Call your Westinghouse representative for complete information on PROGRESSIVE AUTOMATION.

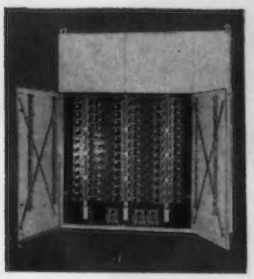
J-96143

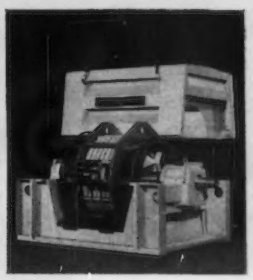
WESTINGHOUSE PROGRESSIVE

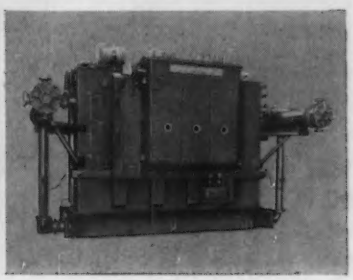
WESTINGHOUSE PROGRESSIVE

AUTO

(Top) Flotation cells, where heavy-duty electrical power is required to constantly mix oil and air with the water and ore. (Lower left) Silicon rectifier unit. (Center) New Westinghouse F/A Motor. (Lower right) Furnace transformer.







# AUTOMATION

MATION

YOU CAN BE SURE...IF IT'S Westinghouse

TUNE IN WESTINGHOUSE-CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29

# WILFLEY SAND PUMPS

*Wilfley 10" Sand Pumps Ready for Shipment*

## LOW COST PUMPING through

- Maintained High Efficiency
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- Long Pump Life
- Quick, Easy Replacement of Parts
- Individual Engineering on Every Application

Lower pumping costs plus increased output make Wilfley Sand Pumps the No. 1 choice of economy-minded plant operators.

If you require belt-driven, overhead V-belt driven, or direct driven pumps, Wilfley has them — available in 1", 1½", 2", 2½", 3", 4", 5" 6", 8" and 10" discharge sizes. They may be fitted with interchangeable electric furnace alloy iron, special application alloys or rubber-covered wear parts.

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"Companions in Economical Operation"
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ENGINEERING AND MINING JOURNAL

JULY 1960

# Wanted—More Basic Information on Pumping Fluid-Solid Mixtures

THE HYDRAULICS INSTITUTE, sponsored by numerous pump manufacturers to provide useful information for industry, has discovered by survey that there is a serious blind spot in one phase of our technological knowledge—we have very little basic information and data on the behavior of fluid-solid mixtures in pipelines. One would certainly conclude that with all the ores, tailings, concentrates and backfilling pumped around in various processes in the mining industry, a wealth of fundamental knowledge on the subject of friction losses for fluid-solid mixtures in pipelines would be available.

A thorough search of available literature by the Hydraulics Institute revealed that "To date little has been published, by anyone, of a comprehensive nature regarding friction losses in pipes" handling fluid-solids mixtures such as gravel, sand, slime, and sludges of an abrasive and/or corrosive nature. A study of fifty articles related to the subject yielded meager information, and much of it contradictory in many respects.

Subsequently the Hydraulics Institute sent out two sets of questionnaires to pump manufacturers, educational institutes, consulting engineering and design firms, and a number of companies in the mining and nonmetallic mining industry. These surveys disclosed: (1) That this subject is of considerable interest. (2) The number of people having actual personal experience in this field is small. (3) Industry needs information on the velocities at which a given mixture can be safely pumped. (4) Industry needs definite data on friction losses of fluid-solid mixtures in pipelines.

In a future issue, E&MJ will publish some of the basic information gathered to date by the Hydraulics Institute on fluid-solid mixtures in pipelines. But more important, we urge those segments of industry which have done research in the field to cooperate with the Hydraulics Institute, 122 E. 42 St., New York 17, N. Y., in making such information available to industry.

# Why Air Pollution Needs Continued Attention

UNITED STATES PUBLIC HEALTH SERVICE released a report recently on "Carcinogenic Bioassays on Air Pollutants," which was prepared by members of the National Cancer Institute, University of Southern California, and the Robert A. Taft Sanitary Engineering Center of the U. S. Public Health Service. This investigation was made because of the alarming increase in the incidence of lung cancer in industrial nations during the past 33 years. In the U. S., the lung cancer death rate has increased from 20 per million in 1930 to 150 per million in 1953. In England and Wales, the rate has increased from about 10 per million in 1920 to 350 per million in 1953.

Suspected causes of lung cancer include frequent administration of X-rays for diagnosis of lung diseases, smoking of cigarettes, smoke and dust of cities, dust of tarred and oiled roads, exhaust gases of diesel engines and automobiles, and industrial gases in general.

Data and tables are included which relate to nonferrous metals workers, mining and quarrying, hematite miners, and worker groups handling asbestos, arsenic, chromium, nickel, iron and radioactive substances.

The tables of specific interest to the mining industry may serve as an alert, and direct the attention of industrial hygiene engineers to areas where more extensive air-pollution control might be neccessary in mines, mills and smelters.

The whole implication of this 20-page report supplemented with 36 tables and 8 figures is that a positive correlation does exist between the soaring incidence of lung cancer and industrial pollutants.

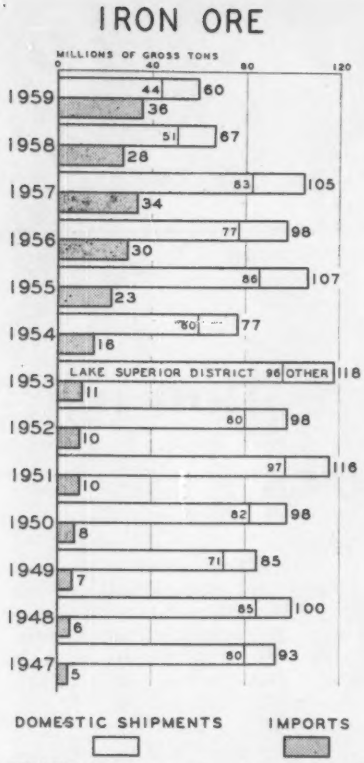



**CHART I.** The growing dependence of the steel industry on imported iron ores is expected to continue.

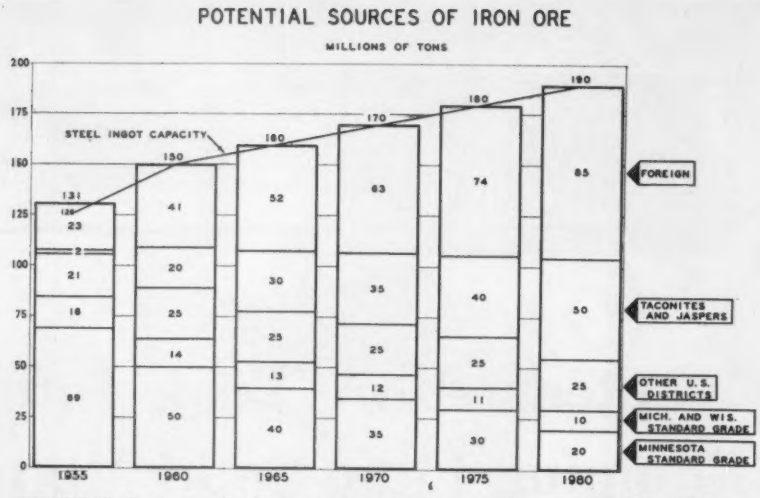



**CHART II.** Just to maintain iron ore production capacity at about 110-million tpy, domestic producers will have to expand treatment plants for taconites and jaspers extensively in the next 20 years.

# The Changing Iron Ore Industry

**H. S. HARRISON**

THREE MAJOR PROBLEMS confronting the iron ore producers today are: (1) foreign competition, (2) the changing character of the iron ore industry, and (3) the present oversupply of iron ore.

## Foreign Competition

Chart I shows foreign and domestic shipments of ore for the period 1947 to 1959, inclusive. By the end of 1960, foreign shipments will be up to about 40-million tons. The significant increase in these imports has had a marked effect on both the price structure and long-term planning of the industry.

The 36-million ton total for 1959 is just the beginning of a long trend upward, as can be seen in Chart II. This shows that by 1980, foreign shipments will amount to about 85-million tons. The majority of foreign ores are high grade. Actually the key factor in Chart II is the growth of high-grade ores, which consist of foreign ore, and concentrates and agglomerates from taconites and jaspers. In 1955 these two categories accounted for less than 20% of the total ore shipped. By 1980 they will amount to more than 70%.

## The Changing Industry

Although standard ores are gradually running out because of tremendous consumption during the war years, an even more important factor to consider is the demand by steel companies for a higher grade product than standard ore. The economics are such that high-grade ores are becoming more a necessity for the blast furnace. Reasons for this are as follows: (1) The large increase in capital costs of a blast furnace which have climbed from $7½-million to $25- to $40-million, depending on how much auxiliary equipment the blast furnace has. (2) Labor costs have gone up from 65c per hr to $3.39 per hr.

When ore of 62% iron replaces ore with 52%, the production of a blast furnace will be increased by 20% from the increased iron analysis alone. Thus if a company has five furnaces, in effect, they have built a sixth if they use high-grade iron ore, and their labor costs would be correspondingly reduced because the same crew would be used to get the additional tonnage. It is just as simple as that.

There is no doubt that ore in the future will have to be high-grade ore to satisfy the customer, and it is obvious that anyone who is going to remain in the iron ore business must be important in both foreign ores and low-grade development. Incidentally, many of these foreign ores, particularly those in Canada, will be concentrates or agglomerates from low-grade ores. Cleveland-Cliffs in Canada has such ores in Albanel, Quebec-Cobalt, Ungava, and two or three other projects now under exploration. The third problem which confronts us is the present oversupply in the iron ore industry.

## Oversupply of Iron Ore

In 1951 there was a scarcity of iron ore. In fact, it was predicted at that time that steel production by 1970 would be limited to 85% of capacity by reason of the shortage of iron ore. Subsequently it appears that

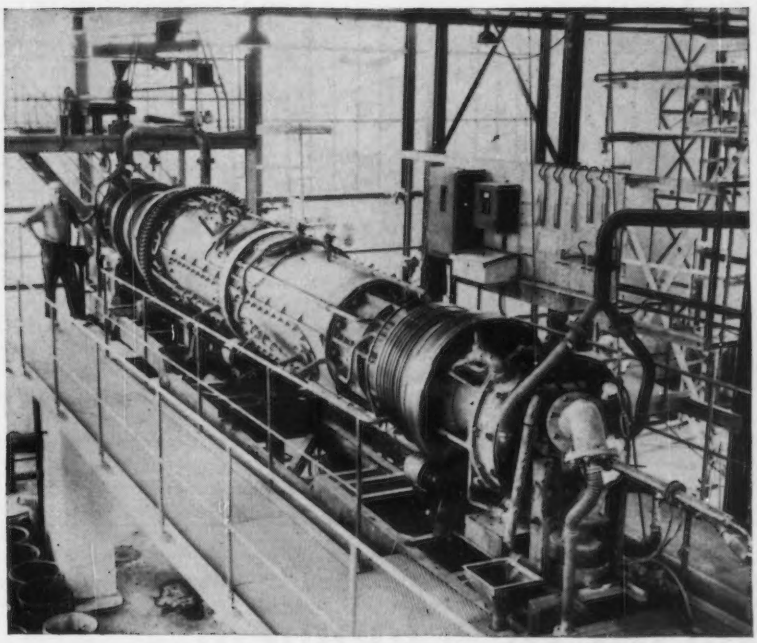
---

Mr. Harrison is executive vice president of the Cleveland-Cliffs Iron Co., Cleveland, Ohio. This article is condensed from an address given by Mr. Harrison before the Security Analysts of New York in April.

that prediction will not be right. Today is a time of oversupply. This is not limited to iron ore, but is present in many raw materials, for example, aluminum, uranium, oil, copper and lead. The nature of the iron ore industry is such that there will always be periods of scarcity and abundance. Cleveland Cliffs is 110 years old, and in this time the pendulum has swung back and forth many times. Actually in my relatively short 23 years with Cleveland-Cliffs, there have been three periods of scarcity and three periods of oversupply. In short then, these periods are not permanent.

The present oversupply is due to the development of properties more rapidly than iron-ore consumption. This, in turn, goes back to the fact that steel production has not kept pace with expectations. The black line on Chart II shows our estimate of steel capacity, and we assume that production will be 80% of steel capacity over a period of years. Note that the estimate for 1960 was 150-million tons (the actual figure on April 1, 1960, was 148.6-million tons). For 1980 the estimate is 190-million tons. This increase of 40-million tons is a very conservative increase because it represents only 1¼% compounded annually, which compares with economic forecasts of Federal Reserve Board Index of 3% annually. This estimate has been made conservatively, because if our premise is correct that production will be 80% capacity, this modest increase in itself is enough to take care of the present oversupply. The question is, of course, can production come up to these expectations? We believe that it can.

Cleveland-Cliffs and partners expect to expand low-grade ore production from 800,000 gross tons in 1959 to 4-million tons by 1964, and to 7-million tons by 1969. Cleveland-Cliffs and partners had a total capacity during the war years of 1943 and 1944 of 5-million tons. At present it is 9-million tons, and by 1969 it should be about 15-million tons, of which 7-million tons will be concentrates or agglomerates of low-grade ore. This illustrates how Cleveland-Cliffs plans to keep up with the changing nature of the iron ore industry.



**MAGNETIZING ROASTING KILNS,** similar to this Dravo-Lurgi half-ton unit, will be installed in pilot plants now under construction to process Mesabi semi-taconites. Crushed ore enters the kiln at the far end. Burners are staggered along kiln.

# Magnetic Roasting for Mesabi Semi-Taconites

TWO MAJOR IRON ORE PRODUCERS have announced plans to build pilot plants to develop an economic process to treat non-magnetic, low-grade iron ores of the Mesabi Range known as semi-taconites. M. A. Hanna Co. is planning a unit at Cooley, Minn., with a capacity of 10 tons of ore per hr. Oliver Iron Mining Div. of U.S. Steel Corp. will build a two-ton-an-hour plant at Coleraine, Minn. Both plants will use roasting kilns supplied by Dravo Corp. under a licensing arrangement with Lurgi Co. of Germany, recently announced to the press.

The kilns will convert crushed semi-taconite from a non-magnetic type to a synthetic magnetic ore that will respond to treatment by magnetic separators.

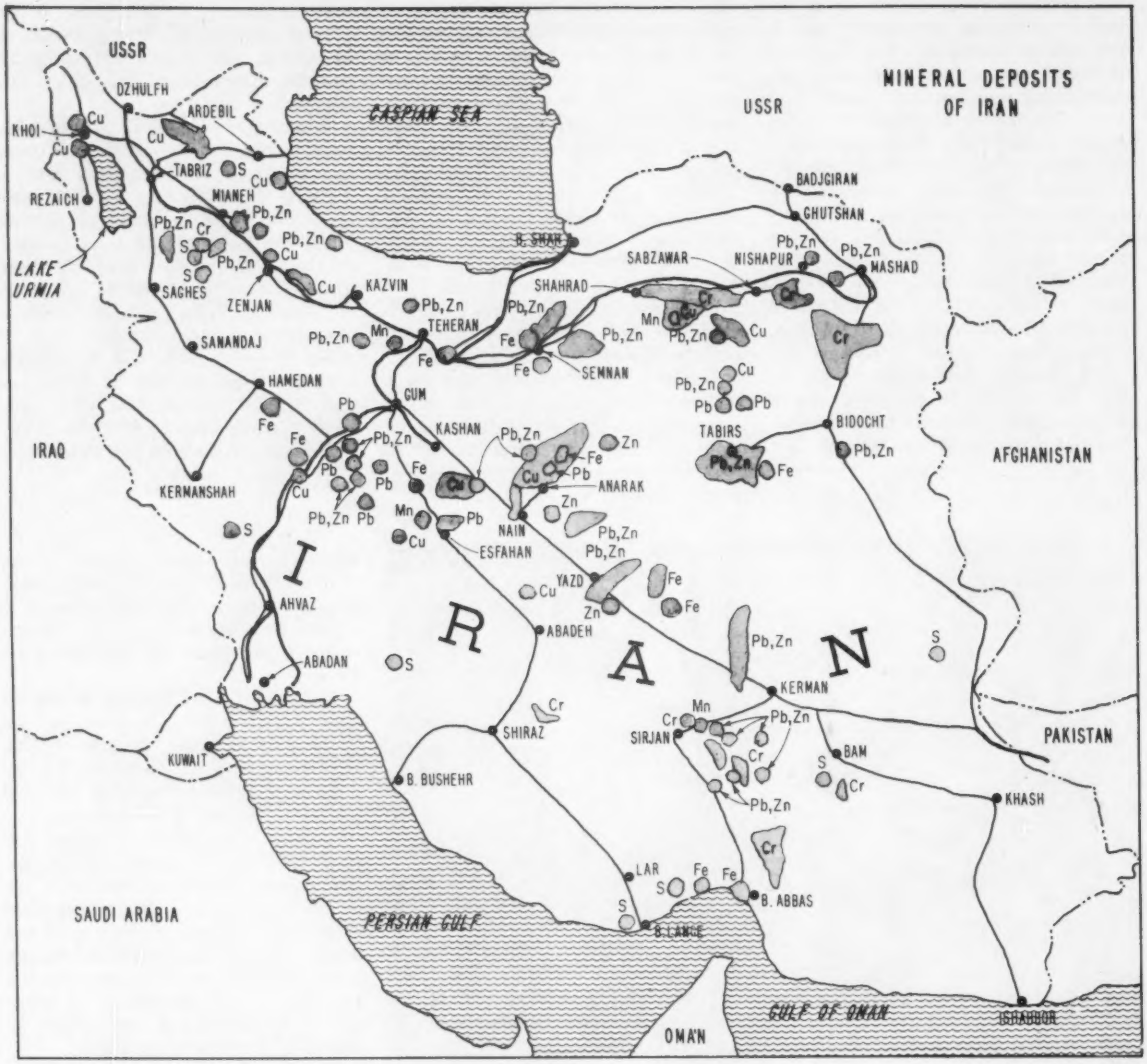
In magnetic roasting, also known as reduction roasting, the crushed ore is heated, and the oxygen content slightly reduced. Reduction must be controlled carefully so that the end product will be the desired synthetic magnetite. Too much reduction will produce a non-magnetic iron oxide. Insufficient reduction cuts down the yield of concentrates. Reduction takes place in a rotating kiln. Crushed ore enters one end of the kiln. Reducing gases are introduced at the opposite end. Fuel is also introduced in burners staggered along kiln wall as shown in the illustration above.

The Hanna kiln will be 88-ft long, and 8 ft 8 in. in dia. It will burn gas from a gas producer unit. In the continuous concentration process the ore will be roasted, cooled, ground and passed to magnetic separators.

Oliver Mining's kiln will be 50-ft long and 6 ft in dia, and will be operated initially with reformed propane gas. However, natural gas or producer gas from lignite or coal can also be used.

Dravo Engineers estimate that a kiln approximately 164 ft by 12 ft with a capacity of 60 to 80 tph would be needed for the smallest practical production plant. For greater capacity, either larger kilns or multiple kilns could be used.

The importance of developing a commercial process for the extraction of iron from non-magnetic, semi-taconite ores is based on estimates that the Western Mesabi Range reserves of such materials total several billion tons.




**LEAD DEPOSITS** are the most widely scattered in Iran, although the country contains good reserves of iron and copper.

# Iran Seeks Mineral Development

**Dr. T. ZIAI**

IRAN, one of the world's potentially great mining countries, is now trying to develop her mineral resources. Concentration and flotation facilities are being introduced in some mines; there are smelting furnaces for the Chah Kharboozeh lead and zinc mines, and a copper refinery at Ghani Abad. Once an ancient center of mining activity, Iran presently exports most of her mineral products as raw ore. Yet the mountainous country, one-fifth the size of the U.S., has a variety of reserves comparatively untouched. Some mining activity has been started by private enterprises, but additional capital, experienced management, and technical skills are required to further develop a mining industry, create employment and promote the national economy.

One way the government is encouraging private investment is by enactment of favorable mining legislation, much of it attractive to foreigners. An unusual part of the law, which reflects the primitive state of the industry, is a section giving the prospector 1% of the value of the products of ore mines.

Dr. Ziai is Undersecretary, Ministry of Industry & Mines, Tehran, Iran.

## A Summary of Iranian Mining Law

In accordance with Article 1 of the Mining Law, minerals are divided into three groups.

Group one consists of building materials such as stones, gypsum, marble, travertine, clay, sand, quartzite, etc.

Group two consists of metal ores such as iron, chromite, manganese, cobalt, copper, nickel, antimony, tin, zinc, mercury, lead, gold, silver and platinum. Salts are also included such as nitrates, phosphates, alkali, borates, magnesite and mineral waters. Solid fuels such as coal and bituminous

substances and precious stones, including diamonds, emeralds, turquoise, rubies, topaz and sapphires complete the list.

Group three consists of crude oil, natural gases, and radioactive minerals including uranium, radium, and all materials utilized for obtaining atomic energy.

The laws governing the exploration and exploitation of minerals are different for each group.

Group one minerals do not require exploration licenses — they are the property of the land owner. Owners may directly obtain an exploitation license and start operation, or transfer this right to another. In case the owner will not or can not operate the deposit, the Ministry of Industry & Mines will lease the deposit to bidders. The lease holder is bound to pay the owner 3% of the products as ownership premiums. Mines located on lands which do not belong to private owners are the property of the government.

Group two minerals require an exploration license from the Ministry. Such a license covers a maximum area of 40 sq km. Any person or party is not entitled to acquire more than one permit; issuance of more than one license requires the approval of the High Council of Mines. Exploration permits for foreign nationals require approval of the Majlis. However, in the event foreign nationals possess shares in a corporation registered under the Iranian laws, they can apply, as any Iranian corporation or individual for license.

Group three minerals are the property of the government; lands on, or in, which such mines are located shall be purchased by the government at a fair price prevailing before the discovery of the mine. The operation either shall be undertaken by the government, or will be put to lease, in accordance with the law.

## Geological Report Needed

Upon completion of exploration operations and discovery of one or several minerals, a geological report and chart covering the area under survey, together with pertinent documents shall be submitted to the Ministry of Industry & Mines. The Ministry will issue an exploration certificate in the name of the holder of the exploration license. The holder of the certificate may transfer his title to another person.

In regard to group one minerals, the operator must pay the government 5% of the products at the site or its equivalent in cash on the basis of prevailing market prices. Should the operator be other than the owner, he must pay the owner 3% of the product as ownership premium.

In the case of group two minerals, the operator must pay the government 4% of the products at the site or its equivalent in cash on the basis of prevailing market prices. Should the operator be other than the owner, in addition he shall pay the owner 3% of the products as ownership premium. In case the operator be other than the explorer he shall pay the explorer 1% of the products or its equivalent in cash as exploration fee.

In the event that a mine is put to lease through competitive bids, bidders should determine the quantity of annual production and the percentage of government dues; upon which the highest bid will be determined and the operation license granted.

## Mineral Production of Iran

(in short tons)

| | Production | Year* |
|---|---|---|
| Antimony | 44 | 1334 |
| Arsenic | 23 | 1327–1331 average |
| Asbestos | 165 (e) | 1336 |
| Hydraulic cement | 2,568,000** | 1336 |
| Chromite | 55,000 | 1335 |
| Gypsum | 551 (e) | 1336 |
| Iron ore | 11,000 (e) | 1336 |
| Lead (mine production) | 18,700 (e) | 1336 |
| Lead (smelter production) | 1,047 (e) | 1336 |
| Manganese ore | 2,205 | 1336 |
| Nickel (content of ore) | 17 (e) | 1336 |
| Salt | 331,000 (e) | 1336 |
| Steel | 132,000 | (future Tehran plant) |
| Zinc (content of ore) | 9,900 | 1336 |

***Iranian year 1336 ended March 20, 1958. **barrels**

(e)—Estimated
Source: 1958 Minerals Yearbook

## Iranian Mineral Resources

Hydrothermal deposits in limestone or Tertiary lava are abundant in Iran and consist usually of copper, zinc and lead sulphate and pyrite. Epithermal prophyritic deposits and substitute ores of lead, zinc and antimony are also known. In the latter part of the Mesozoic and the beginning of the Tertiary, basic intrusive rocks such as peridotite and pyroxenite were infiltrated by ore solutions. Segregated chromite deposits exist and in a few places serpentine magnesite has been formed. Apart from deposits related to magma, sedimentary deposits such as coal, gypsum, salt and potassium salts have been found. Still being formed are salt deposits such as sodium sulphate and borax. Among the metamorphic deposits are manganese, turquoise, alumite and various clays.

**Iron ore deposits,** containing 60% Fe, are in three magnetite hills near Semnam. Potential reserves of the phosphorus-free ore is not yet accurately estimated. The Trans-Iranian Railway passes near the deposits.

Magnetite deposits have been discovered in Kerman Province, at Bafgh, Narikan and Zirkan; total reserve is about 30-million tons with a grade of 54%. Proximity to coal mines makes this deposit important.

The most important iron deposit on which studies have been conducted is at Shams-Abad, Arak. Exploration started in May 1956 and so far the results have been satisfactory. The ore is limonite or hematite mixed with limestone and silica, containing a small portion of manganese and sulphur, with an average purity of 47%. Its apparent reserve is about 30-million tons. Presumably the total reserves exceed 100-million tons.

Other iron deposits of Iran are in Chasr Firouzeh, near Tehran and the Southern Isles of the Persian Gulf, the most important of which are Foroor Island and Amol.

**Manganese deposits** are found in Ardestan and the province of Tehran. Among the deposits in Ardestan, one is located 23 km southwest of the city, in the upper strata. The haussemanite, braunite and psilomelanes ores have an average Mn content of 54%. In this region several veins have been exploited including those at Kuhe Dobaradaran and Bagham.

Psilomelane ore from the Robat Karim mine in the Tehran region is an impure, black oxide with 4.7 specific gravity. The 30% ore can be increased to 44% by concentration. No further exploration is required in the mine that consists of two parallel veins with a reserve of 100,000 tons. In this region other veins have been discovered by geophysical surveys. Thus, the reserve may be estimated around 500,000 tons. At present the annual production is about 25,000 tons.

**Chromite** in the northern region is occasionally combined with copper. The width of the intrusive rocks ranges from 15 to 50 km. Basic rocks such as peridotite and dunite are host

rocks for mineralization. In the vicinity of Foromad, the mines have a reserve ranging from 5 to 20,000 tons each. Quarries yield an ore containing 46% to 50% chromium oxide, well-proportioned with iron. Many of the mines are situated close to the Tehran-Meshed railway.

Chromite mines in the southern region are located in intrusive rocks running 150 km from east to west. The major deposits have been exposed at Esphandagheh, Bagh Borj, Marseen and Abdasht. In this region, chromite can be satisfactorily concentrated and the chromium oxide is well-proportioned with iron oxide. What makes these mines of particular importance is their nearness to the open sea.

**Two tungsten mines,** Roosht and Hassan Abad, are southwest of Shahzand, Arak. The ore is a compound of scheelite, cassiterite and chalcopyrite, accompanied by tourmaline. The Hassan Abad mine has a reserve of 30,000 tons, with 0.8% tungsten. The mines have been operating for about two years.

**Lead** is the most important mineral exported from Iran. The ore contains 35% Pb; below this percentage it is not exportable. Since the production of the lead mines is increasing, it is hoped that by providing concentration facilities and by increasing the grade of the ore, the export will be considerably increased. Already a few private mines are equipped with flotation and concentration facilities.

Generally, lead and zinc deposits in Iran are found in hydrothermal veins in calcareous rocks. The essential ore in the deposits is galena, but cerusite, hydrozincite and calamine are also found. In Iran, galena is associated with silver. In the Nakhlak Mines there are layers of two meters thickness. The ore is composed of cerusite and galena, with 30% galena. Large lenses of ore have already been extracted from a depth of 100 meters.

A waterjacket furnace and smelting furnaces have been provided for both Chah Kharboozeh mines. Lead is produced in the form of ingots and brought to the market for sale. The mines are highly important and are worthwhile for establishing large facilities for exploration, production and smelting.

Zinc is produced from calamine ore at Shahkooh, Isfahan. Another lead and zinc mine in Isfahan is at Khaneh Sourmeh.

A Franco-Iranian corporation is working lead mines at Lakah, Darre-Noghreh and Baba Sheik, located close to the railways. The corporation has a 300-tpd concentrator.

Operating lead mines, equipped with concentrators, are at Ozabkooh and Chah in Tabas, and have considerable reserves. Other lead mines are near Zanjan, Mazandaran, Ardestan, Tabas and Yazd. There are five other lead mines in Iran.

**Copper resources** in Iran are comparatively good and exportable. Most mines are operated as open pits. The main copper ores are chalcopyrite, although native copper has occasionally been found. Oxide ores are also present.

The most important copper deposits are Talemsi and Meshani mines in Anurak and those at Abbas Abad. They are all porphyritic deposits. In these mines the 3% to 5% Cu ore consists of chalcosite and bornite. Large pieces of native copper as heavy as 500 kg have been found in the mines. With the ore are traces of nickelite and erythrite.

Ores produced in the mines are sent to the 25 to 30 tpd copper refinery at Ghani Abad. The production of Ghani Abad is around 3.5 to 4 tons of electrolytic copper daily.

The nickelite obtained from the mines is turned at Speiz. Mines located at Abbas Abad are: Choghandar Sar, Damane Chal, Maadane Bozorg, Labecal and Ghoorkhan, the last two being worked at present.

The ores averaging 70% Cu are treated and then sent to the Ghani Abad foundry. There are 11 other copper mines in Iran. Antimony deposits occur in Hamadan and in the Ferdows area. The Baharloo antimony mines in Hamadan contain hydrothermal and epithermal veins in trachyte. The length of veins vary but the most important one has an apparent length of 300 m, with an average thickness of 10cm. The ore is concentrated to 35%. Other mines are at Kooh Shoorab, in Ferdows (Khorassan), and near Anarak; the exploration of neither one is as yet complete.

**Magnesite** has been explored at the Piazi area in Fariman, 60 km from Meshed. Here the ore occurs in peridotite intrusive rocks metamorphosed into serpentine. The rock has 18% magnesite, with a reserve of 100,000 tons, and is used for making fire bricks. Other mines are found in the vicinity of Naeen and at Beshaguerd of Jiroft.

**Sulphur** mines are in Tertiary sediments. Explored sulphur mines are: Bostaneh, near Bandar Lengueh, with 200,000 tons reserve; Delazarian, in Semnan; Kooh Googuerd, in Semnan; and Takbah, in Zanjan.

At present the Semnan mines supply the greater proportion of internal sulphur consumption; however, it is expected that increased production at Semnan could cover the entire internal demand.

**Red iron oxide** is produced in Hurmoz Island in the Persian Gulf. The ferrous oxide of this island is considered one of the best of its kind in the world market; approximately 10,000 tons of red oxide is produced annually. The mine contains a reserve of 500,000 tons, and the production may be increased with the application of modern methods. Other iron oxide deposits are in Gonabab, Bajestan, Gheshm Island, Bahr-e-Asseman and Hengam.

**Numerous salt plugs** exist in southern Iran in the Hurmoz series. Over 100 salt domes are known in southern Iran, with others in the process of formation.

The Hurmoz Island is a round salt dome, 8 km in dia. Salt Mountains, 6x4 km in area, cover the central part of the island. Hundreds of millions of tons occur in salt layers that are separated by colored salt containing iron and manganese, with 2% insoluble ingredients. Other important salt mines in Iran are at Sultan Abad, Neishabur, Hessar-Yazdan, Emarloo, Abgho (Neishabur), Ivankey (Tehran), Ghom and the salt-bearing grounds around the salt lake, Rezaiyeh.

**The turquoise mine** near Neishabur is the world's best and Iran's most important. Turquoise occurs on the surface with feldspar and apatite, and occasionally in the form of veins 2 mm thick and from 1 to 2 m long within crevices. Although the mine has been in production for a long time, there is the possibility of increasing the annual production to 6000 kg, by modernizing the equipment. Another turquoise mine which is comparatively less important is located at Tabas.

**Gold** occurs disseminated in quartz veins. In places, gold is extracted by local people from river beds. Astaneh in Arak can be cited as good examples.

The newly-discovered gold mine near Golpayegan is one of the most important in Iran. The ore is a quartz containing from 15 to 17 gr. gold per ton. The total reserves of quartzite is around 158,364 tons and the total reserves of gold is estimated to 2,648,700 grams.

Other deposits consist of coal, borax, fluorite, apatite, kaolin, arsenic, mica and various stones for construction.

# Digital Computers Cut Survey Costs

**GRANT J. HARVEY, JR.**

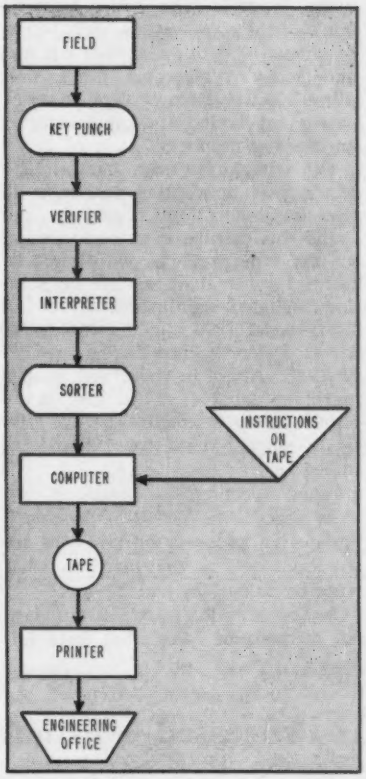
UNION CARBIDE NUCLEAR CO. processes survey data at Uravan, Colo., with an electronic digital computing machine. Not only is the new method faster and cheaper than conventional processing, but it is also more accurate, even when two surveyors work independently. The company hopes the method will allow it to increase its grade of personnel through the elimination of the routine drudgery of making simple calculations. Although surveying drill holes showed the most improvement, the method has proved effective for all types of surveying.

The electronic digital computing machine rents for $6 per minute on day shift, and can perform calculations in that one minute which would take two surveyors 15 days working 8-hour shifts. Not only are the final results more accurate, but they are obviously less costly, even at $6 per minute. The use of electronic computers to solve routine problems can prove not only to be efficient, economical and more accurate than manual methods, but can free technical personnel to do more constructive work which will pay off in services, the value of which can only be measured in reduced cost of operation.

Where our eight field crews at Uravan, Colo., each spent approximately 16 hours per week calculating, they now spend approximately one hour per day checking their work and preparing it for machine computers. This alone has resulted in a 20% gain in efficiency.

The cost of calculating a stadia shot by manual means was approximately $1. The total cost of computing stadia shots by computer, including key punching costs, is 36c. During trial runs, we found running 200 shots at a time cost us 10c per shot, where running 40 shots cost us 50c per shot, not including key punching costs. This is because the first computer runs required the instructions to be read by the card reader requiring approximately 3 minutes ($18 of cost). Recently the instructions have been placed on a magnetic tape and are read into the computer's memory in about two seconds. This action has reduced the fixed costs of setup.

An even more startling saving was realized when comparing the manual calculation cost of $2.50 per traverse station to the 36c per station cost attained by the machine.




**MAGNETIC TAPE** is latest addition to computing system. Computer is sixth step.

The key punching costs are from 6- to 12c per card or shot. This can probably be cut in half with small revisions in forms.

Efficiency and saving of individual projects are affected differently. Surveying drill holes showed the most improvement. The cost of surveying and computing a drill hole location was in excess of $6 per drill hole. By using machine computers, the cost can be dropped to one-third, or $2 per hole. Another way of expressing this is in the number of drill holes shot in and calculated per crew shift, which has been increased from 12 to over 30 holes. Efficiency is little affected by machines in daily work in mines using only one or two station setups followed by stope or drift detailing.

The accuracy of electronic computers was found to be an improvement over hand calculations even where two surveyors calculated independently. This is not a reflection on integrity, but rather indicates that where two men are checking each other's work, that work done by the dominant personality takes on a certain weight even though it may be less accurate.

The feeling toward electronic computers by the survey crews is mixed, depending on the personality of the crew. Some engineers find difficulty putting field notes in neat enough shape to be interpreted by a key punch operator. On the other hand, surveyors who do not particularly like office work welcome electronic computations.

As has been observed in other companies using computers, the ability of a person becomes more apparent when the routine drudgery is taken from him. For this reason the grade of personnel should be improved in the future.

The profit from the use of digital computers becomes readily apparent when reviewing the engineering problems and procedures used at Uravan. The Uravan office takes care of the surveying for approximately 125 mines contained in over 2,000 claims, found in a narrow strip of plateau land, 50 miles long, accessed by dirt roads running up winding canyons and traversing across rims and talus slopes of the sandstone and shale formations of the Uravan Mineral Belt. These roads, during moist weather, can become almost impassable due to a grease-like mud formed from the decomposing shales. For these reasons much of the engineer's day is spent in traveling.

The annual exploratory drilling to keep the mines in ore amounts to roughly 5,000 holes which must be surveyed with enough reliability to be intersected at mining depth.

The boundaries of the active claims must be accurately located to prevent trespasses on to neighboring claims. The boundaries of the less active claims are also being surveyed.

The drill holes and many of the claim corners are surveyed by stadia from closed chain traverses. When the location of a claim is accurately required, the claim corners are chained in from closed chain traverses.

The closed chain traverses originate from triangulation nets, which are the basic control for the major portion of the engineering work at Uravan.

Traverse legs are all double-chained. When the calculated components of both chaining lengths

Mr. Harvey is production engineer for Union Carbide Nuclear Co., Uravan, Colo. Mr. Harvey's paper was presented at the April 21-23, 1960 meeting of the Colorado Mining Association.

agree to less than one foot in 1,000 for the vertical component, and one foot in 2,000 for the horizontal component, the average of the values is accepted as the true value.

Except in the case of chaining base legs for triangulation nets, corrections for temperature and sag are not applied to chain lengths.

The azimuth is carried by doubled angle rights, which are also required for all stadia shots. The azimuth closure must not exceed the product of the least reading of the transit multiplied by the square root of the number of angles turned. The adjustment of an acceptable azimuth closure throughout the traverse is done at the discretion of the surveyor.

Adjustment of the linear closure is done by the mathematical procedure described in most surveying texts under the title of "Compass Rule."

Calculation of stadia shots is done to the northeast coordinate system. All manual calculations are made by two men using separate calculation sheets, checked against each other at convenient stages of calculation.

Each day two of the eight two-man crews had to be scheduled to do the simple but arduous calculations.

This tie-up of technical personnel in routine work, and also knowledge of what machine computing has done for the accounting field, led us to make inquiries into what machines could do for surveyors. We found, of course, that this idea was not new and many engineering firms were using electronic computers to compute many varied and quite complex engineering problems.

Our company already had an IBM Model 604 accounting calculator in operation in Grand Junction, but found this calculator to be too small for the type problems we desired to solve. Future plans of the corporation included the installation of an IBM Model 7090 digital computer in the New York office during the fall of 1960. Although there are smaller machines capable of solving survey problems, we selected the IBM 704 to do our job until the 7090 is installed.

After selecting the computer, we then, with the help of IBM personnel, designed a program or chain of instructions telling the machine what must be calculated and how.

In designing the program, the manual methods of calculation were followed as closely as possible, with only one exception being made, and this will be described later.

While we designed the program to solve problems which took most of our crews' time, we were careful not to limit it to our present problems by limiting the obtainable accuracy.

The problems we decided to work first were:

1. Solving traverses closing on starting point.
2. Solving traverses which close between two known points. This type problem in the scope of this report will be termed open traverses with balancing.
3. Solving truly open traverses which, in other words, have no closing point.
4. Solving elevations and coordinates of stadia shots.

The next step was to design forms from which the IBM cards are punched which put field information and necessary starting and closing information into IBM machine language. These forms were also designed so that no interpretation or survey knowledge is necessary for anyone involved in the series of steps required to solve the problem.

# How The Survey Data Is Processed—From Field To Office

## Organizing and Processing Data

From the field, information is sent to a key punch operator who punches it into IBM cards.

The punched cards proceed to another key punch operator who simulates the punching of the first operator. The second key punching machine is set only to check the punching of the first. If no error is found, a nick is punched on the right hand side. On the other hand, if an error is noted, the nick on the side is omitted, and a nick is placed over the column where the error was noted. This step is called verifying.

After cards are checked for errors and corrected, they are put in the interpreter which transcribes the punches back into figures and letters and types them on the top of the card.

The cards are then put into the sorter, which places the cards in their proper order according to sequence number.

The card information is then placed on a magnetic tape and with the computer's program instructions electronically proceeds into the computer. As many as 200 traverse points and innumerable stadia shots can be computed on one run.

The computed information is then placed on a magnetic tape, which is a storage place between the computer and printer.

The magnetic tape printer prints at the rate of 150 lines per minute. The printed sheet then is sent to the Uravan Engineering office. (See flowsheet on preceding page.)

INITIALIZATION CARD
FOR TRAVERSE POINTS - OPEN AND CLOSED

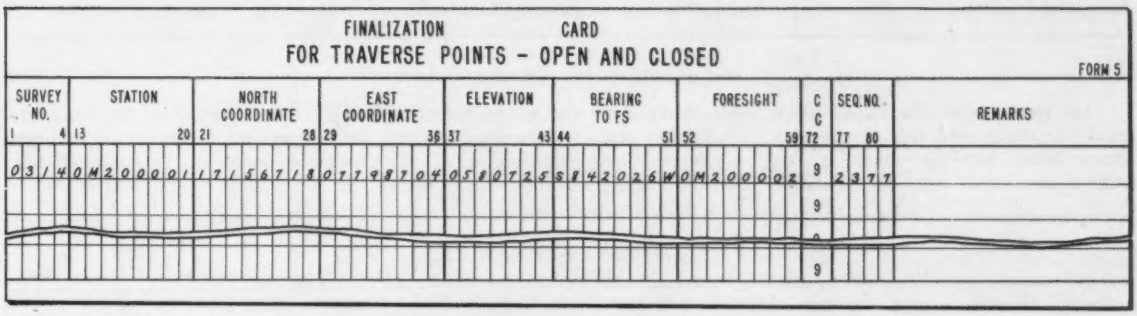
FORM 4

| SURVEY NO. 1–4 | BACK SIGHT 5–12 | STATION 13–20 | NORTH COORDINATE 21–28 | EAST COORDINATE 29–36 | ELEVATION 37–43 | BEARING TO BS 44–51 | SC 71 | CC 72 | SEQ. NO. 77–80 | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0314 | 0M200002 | 0M200001 | 1715671 | 8079879 | 0508072 | S84202 6W | 0 | 6 | 2376 | |
| | | | | | | | | 6 | | |
| | | | | | | | | 6 | | |

## Initialization of Open and Closed Traverse

The card form has 80 columns, all of which may or may not be used. If they are not used, they can be omitted, blacked out, or if occasionally used, must be filled in with a zero when not used.

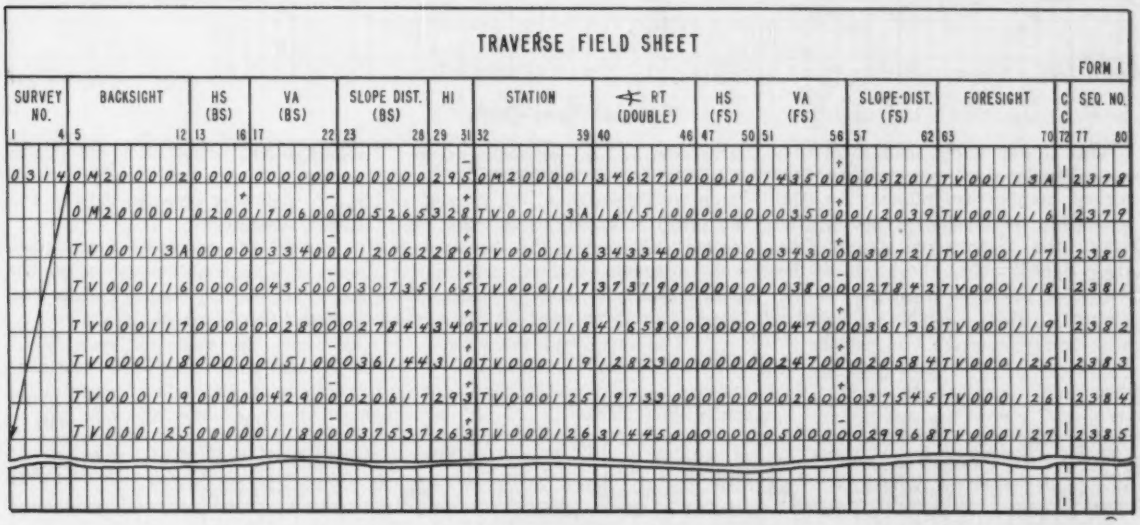
The illustrated form shows our initialization card for traverses, which have a closing point and require balancing. Columns 1 through 4 contain the identifying survey number. The 3 in column 2 identifies the surveyor, and this is his 14th problem solved by the computer. These four columns can contain a numeric or alphabetic character. Columns 5 through 12 contain the starting backsight. In this case, the station is station No. 2 in the Mill No. 2 mine. Columns 13 through 20 contain the starting instrument station, and would be station No. 1 in the Mill No. 2 mine. Columns 21 through 36 contain the north and east coordinates of the starting station to the 1/100 ft. Columns 37 to 43 contain the elevation of the starting station to the nearest 1/100 ft. Columns 44 through 51 contain the bearing from the instrument station to the backsight. In this case reading south 84 degrees, 20 minutes, 26 seconds west. The 26 seconds is, of course, meaningless for the order of surveying ordinarily used in our traversing. This is a result of not wanting to limit the accuracy of the machine. Columns 52 through 70 were not needed, so were omitted. Column 71 contains the stadia correction of the transit used in this survey. Column 72 contains the card code number, which tells the machine what type of problem is going to be solved. Columns 73 through 76 were omitted. Columns 77 through 80 contain the sequence number which determines the order in which the cards enter the machine.




## Finalization for Open And Closed Traverse

For traverse which has a closure point other than the starting point, we must give closing information. This is put on a finalization card.

We again have the survey number, followed by closing station, north and east coordinates of the closing station, elevation of the closing station, bearing from the closing station to the final soresight, the final foresight, card code, and sequence number, which would be the number immediately following the number on the initialization card. The absence of this card would tell the machine to close back on the starting point. In the particular problem on these sheets, the traverse closed back to the starting point and the finalization card could be omitted. On this card, the foresight is added and the backsight is eliminated.




## Traverse Field Data

This sheet is the field sheet for traversing and directly puts field information into computer language. We again have survey number, which is repeated for every following card. Rather than rewrite the survey number, an arrow is drawn crossing those columns which are repeated.

Following the survey number is the backsight, height of sight to the backsight, vertical angle to the backsight, slope distance to the backsight, height of instrument above or below instrument station, instrument station, angle right doubled reading 346°-27'-

00", height of foresight above or below foresight station, vertical angle to foresight, reading plus 14°-35'-00"; slope distance to foresight; foresight station; card code; and finally sequence number. Any time a number can have a positive or negative value, the sign indicating this is placed over the number in the last column.

INITIALIZATION CARD
FOR STADIA POINTS

FORM 7

| SURVEY NO. (1–4) | BACK SIGHT (5–12) | STATION (13–20) | NORTH COORDINATE (21–28) | EAST COORDINATE (29–36) | ELEVATION (37–43) | BEARING TO BS (44–51) | SC (71) | CC (72) | SEQ. NO. (77–80) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| 0103 | OTB001128 | OTB001129 | 2112141406 | 6347100538 | 03652 | 12900E | 1 | 8 | 0700 | |
| 0103 | OTB001111 | OTB001122 | 2121106006 | 8763100571 | 91845 | 47005E | 1 | 8 | 0702 | |
| | | | | | | | | 8 | | |

## Initialization for Stadia Points

This form shows the initialization card for stadia and side chain, side chain being traverse which is not closed and need not be balanced. We again have the survey number, backsight station, starting station, north and east coordinates of the starting station, elevation of the starting station, bearing to the backsight, stadia correction, card code, and card sequence number. This card is used for the station on the card below.

STADIA FIELD SHEET

FORM 3

| SURVEY NO. (1–4) | BACKSIGHT (5–12) | HI (29–31) | STATION (32–39) | ∢ RT (DOUBLE) (40–46) | HS (FS) (47–50) | VA (FS) (51–56) | STADIA DIST. (FS) (57–62) | FORESIGHT (63–70) | | SEQ. NO. (77–80) | NEEDLE | ∢ RT (SINGLE) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0103 | OTB001128 | 301 | OTB001129 | 3300500138 | 1 | 1839000 | 000036 | SW03COR1 | 4 | 0701 | N36-15W | 165-02 | 15.62 13.81 12.00 3.00 |
| 0103 | OTB001111 | 244 | OTB001122 | 3755200628 | | 0148000 | 000656 | EH17COR2 | 4 | 0703 | N38-30W | 187-56 | 9.56 6.28 3.00 |
| | | | | 4513200563 | | 0038000 | 005255 | B002COR4 | 4 | 0704 | NORTH | 225-46 | 8.25 5.63 3.00 |
| | | | | 4712000563 | | 0020000 | 005315 | EH17COR3 | 4 | 0705 | N10-00E | 235-40 | 8.31 5.66 3.00 |
| | | | | 4840100573 | | 0010000 | 005455 | EH16COR2 | 4 | 0706 | N16-00E | 242-01 | 8.45 5.73 3.00 |
| | | | | 5110500602 | | 0012000 | 006048 | B002COR1 | 4 | 0707 | N30-00E | 255-32 | 9.04 6.02 3.00 |
| | | | | | | | | | 4 | | | | |
| | | | | | | | | | 4 | | | | |

## Stadia Field Data

This is our stadia field sheet and is similar to the traverse sheet. The survey number is followed by the backsight; the height of the instrument; the instrument station; the angle right doubled; the height of the foresight; the vertical angle to the foresight, stadia distance, foresight, card code, and the sequence number.

The other data on this sheet is not computer information, but is used by the draftsman to check that the plotted information is harmonious with magnetic reading and single angle right. In reading stadia, the Uravan surveyors read all three hair readings and check that the center reading is mathematically within 1/100 ft, half way between the top and bottom readings.

Coding of information is necessary in some cases as noted on the foresight. The top line is Corner No. 1 of the Salt Wash No. 3 claim.

SIDE SHOT FIELD SHEET

FORM 2

| SURVEY NO. (1–4) | BACKSIGHT (5–12) | HI (29–31) | STATION (32–39) | ∢ RT (DOUBLE) (40–46) | HS (FS) (47–50) | VA (FS) (51–56) | SLOPE DIST. (FS) (57–62) | FORESIGHT (63–70) | OCC (71) | CC (72) | SEQ. NO. (77–80) | NEEDLE | ∢ RT (SINGLE) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0314 | TV000119 | 293 | TV000125 | 3661200 | 0 | 0000011 | 200 | 029935 | TV000129 | 2 | 2390 | N33-30E | 183-06 | |
| | [redacted] | 301 | TV000129 | [redacted] | | 0000002 | 170 | 029955 | TV000125 | 3 | 2391 | S33-30W | —— | |
| | [redacted] | 301 | TV000129 | 3595600 | | 0000012 | 800 | 017272 | BM44TS001 | 2 | 2392 | N33-30E | 179-58 | GOV'T BENCH MARK |
| | | | | | | | | | | 3 | | | | |

## Open Traverse Field Data

This form shows the side chain or open traverse field sheet. As before, it contains pertinent field information. This sheet is used for two types of problems. The first type is open traversing where each leg is double chained. When this problem is being solved two cards are dependent on each other and a figure two is placed in column 71. The instrument station of card code 2 becomes the foresight on card code 3, and the foresight on card code 2 becomes the instrument station on card code 3. This is done to allow for the second leg chaining.

The second type of problem requires only one chain distance and no card will follow to complete the required information. In this case, a one is placed in column 71 as on card no. 2392.

## . . . Results Are Summarized On Machine-Printed Form Errors Do Not Stop Computer—They Are Merely Noted

HEADER CARD DATA ►

SURVEY ERRORS ►

STATION INFORMATION ►

CLOSING PRECISION ►

```
0314 0M200002 0M200001 17156718 07798704 0580725 S842026W                    0
ERROR (DH1+DH2)/HD2 IS  .0011 CARD NBR IS2379

ERROR (DH1+DH2)/HD2 IS  .0011 CARD NBR IS2380

ERROR (HD1-HD2)/HD2 IS  .0006 CARD NBR IS2381

ERROR (DH1+DH2)/HD2 IS  .0011 CARD NBR IS2382

ERROR (HD1-HD2)/HD2 IS  .0012 CARD NBR IS2389

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 0M200002 0M200001 17157802  7803619  581743 S842026W    5033 TV00113A N773353E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 0M200001 TV00113A 17169002  7799205  582201 S773353W   12039 TV000116 N213039W

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV00113A TV000116 17195616  7784008  584487 S213039E   30647 TV000117 N294342W

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000116 TV000117 17221231  7773099  584361 S294342E   27842 TV000118 N230415W

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS

0314 TV000117 TV000118 17257200  7776507  585209 S230415E   36129 TV000119 N052442E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000117 TV000118 17257200  7776507  585209 S230415E   36129 TV000119 N052442E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000118 TV000119 17250036  7757240  586525 S052442W   20557 TV000125 S693610W

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000119 TV000125 17213272  7764803  587111 N693610E   37536 TV000126 S113723E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000125 TV000126 17188597  7781604  584760 N113723W   29852 TV000127 S341456E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000126 TV000127 17166003  7794030  582754 N341456W   25787 TV000128 S284829E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000127 TV000128 17157801  7803622  581739 N284829W   12620 TV00113A S492801E

SURV    BS      STA       NC       EC      ELEV   BR BS      HD      FS      BR FS
0314 TV000128 TV00113A 17156718  7798704  580725 N492801W    5037 0M200001 S773426W

SURV  PREC BRER ELVER
0314 26474 002R 00010
```

This is a print out of the computed traverse. The first line is a reproduction of the header card information. Lines 2 through 6 are print outs of discrepancies in components of slope distances that exceeded the limits that were allowable. Lines 7 through 18 show the survey number, the backsight station, the instrument station, the north and east coordinate of the foresight station, the bearing from the instrument station to the backsight station, the horizontal distance to the foresight station, the foresight station, and the bearing from the instrument station to the foresight station.

Line 19 shows the closing precision information of the survey. The closing precision in this case is slightly better than one in 26,000 ft. The bearing closure was 29 seconds under a full geometric figure. The "R" is a code letter for a minus 9. The elevation error was 18/100 ft under what it should have been, the "Q" being the code letter for a minus 8.

The bearing closure of 29 seconds is distributed equally in seconds to all the angles turned, any excess of seconds is added a second at a time to the first angles until the excess is consumed. We again get bearings out to seconds which is, of course, meaningless. This has one advantage of not placing large parts of the correction in any particular part of the traverse. This is the only difference between machine computing and manual computing.

Errors picked up by the computer do not stop the calculation process; they are merely noted. As is observed in this print out, the errors were relatively small, and the closure was good in all respects. Field checks were thought to be not needed in this instance, and the survey was accepted as computed.

The other errors the machine checks for are mostly listing errors, but again these are only noted and calculation resumes.

Our plant has been using electronic computers for only four months and direct results are only generally surmised at this time. Costs are only estimates, and as we use this medium of computation more, our efficiency and accuracy in field work will increase and costs will drop to a leveling off place. Improvements in computer systems can also reduce costs.

**EPOXY COATING** protects 272 cell tanks against attack by hot, acid electrolyte in direct reduction process.

**REGULAR INSPECTION** reveals no loss of epoxy coating. Conventional process, before 1957, used mastic tank linings.

# Epoxy Resins Protect Concrete Tanks

INTERNATIONAL NICKEL COMPANY of Canada Ltd. has been reaping the benefits of improved maintenance and satisfactory cost from a step it took five years ago, namely, installing a protective coating of epoxy resins in the reinforced-concrete electrolytic cell tanks of its Port Colborne, Ont., nickel refinery.

Necessity was the mother of invention in the development of the epoxy resin coating. Necessity took the form of Inco's development of a direct-reduction electrolytic nickel-refining process; and this drove Inco and Shell Chemical Co. scientists to develop the new cell-coating material.

## Refining Process Simplified

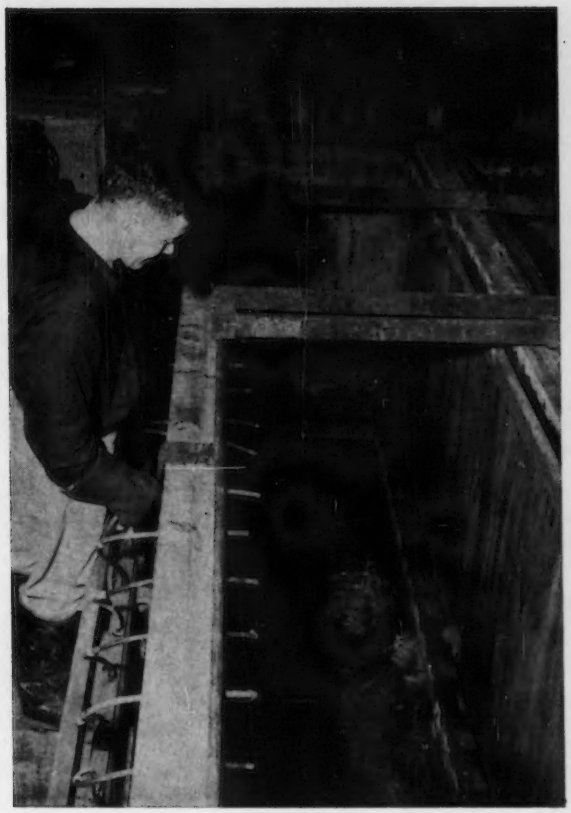
Conventionally, the electrorefining of nickel used a two-stage process: first, of producing crude nickel metal anodes; then, of electrolyzing them in a sulphate-chloride electrolyte to produce the refined metal (L. S. Renzoni, U.S. Patents 2,394,874; 2,448,462; 2,367,239). The complex first stage involved sintering Bessemer matte to produce nickel oxide, then reducing this to crude metal and casting it into anodes.

Inco commenced investigations in 1951 to try to improve its refining process by eliminating the high-temperature operations. It was found possible to cast nickel sulphide anodes directly from Bessemer matte and electrolyze these (Renzoni, McQuire and Barker, "Direct Electrorefining of Nickel Matte," JOURNAL OF METALS, June 1958). This simpler process yielded the advantages of greater efficiency and easy recovery of selenium, precious metals and elemental sulphur. Nickel is essentially in the ionic state in the sulphide anodes, and by electrolysis virtually all the nickel is deposited on the cathodes. The sludge remaining consists of 95% elemental sulphur and small amounts of sulphide particles, selenium and precious metals. These materials are subsequently recovered.

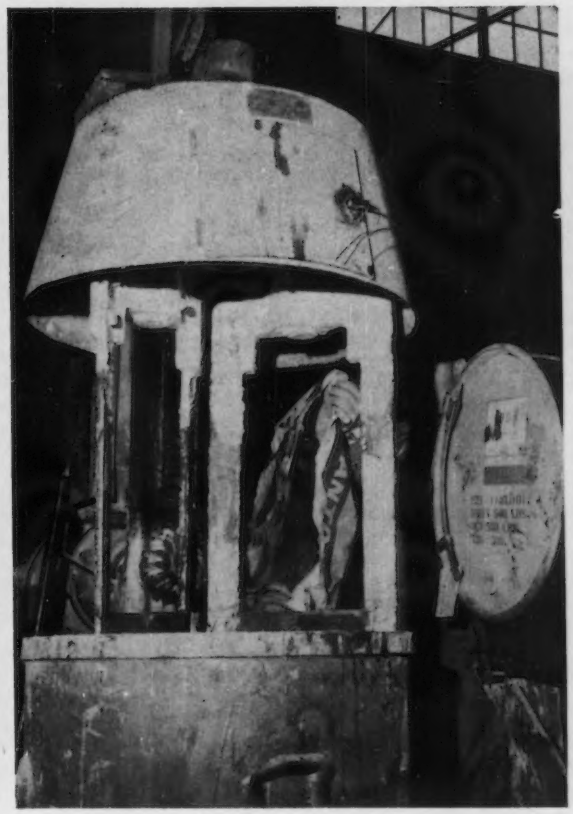
The new process brought problems, however. For one thing, the cell operating temperature rose to 160°F, because of higher cell voltage; it had been 140° before. For another, the discharge of hydroxyl ions raised the acidity of the bath to pH 1.9, where it had been pH 4.0; it also lowered the current efficiency to 95% from a previous 99.5%. The hotter and more acid environment quickly attacked the mastic linings which had protected the tank walls in the conventional process. Without a suitable protective coating, Inco could not use its new process.

## Extensive Tests Required

An extensive testing program began, which after many failures, produced the successful epoxy resin, an Epon (R) resin made by Shell Chemical Co. Some of the failures encountered: tank linings would be dissolved by the acid electrolyte; linings cracked soon after installation; linings did not maintain suitable dielectric characteristics; and, cost was prohibitive. Inco installed the epoxy resins in 1955 and 1956 on 272 refining tanks at the Port Col-



**MANY OTHER COATINGS** were tried in an extensive testing program during pilot plant stage of direct reduction process.



**A BATCH MIXER** was used to mix Epon resin with fillers near installation site. Three coatings were applied.

# In Direct-Reduction Nickel Refining

borne plant, and commenced the new direct reduction process, and hence subjected the tank linings to severe service, in January 1957. The linings have since resisted the attack of high temperature and acidity, and continue to give good protection to the tanks.

Shell Chemical specialists aided Inco's own staff in developing the epoxy coating and installation procedures, during the electrochemical pilot plant stages of the process. The concrete tank surfaces were prepared for the resin coating by removing the mastic, then sandblasting the tank walls to provide for adhesion.

## How Epoxy Liner Was Applied

The epoxy coatings are two-part formulations consisting of resin and curing agent. These ingredients were mixed just prior to application of the coating. The short pot-life of the epoxy mixture makes it undesirable to mix quantities that cannot be applied within an hour. At Port Colborne, the epoxy tank lining material was applied in three stages: a first, or leveling, coat; an impregnating coat; and a finish coat. Mixing took place on the site in a batch mixer.

## Epoxy, Santocel Mixed

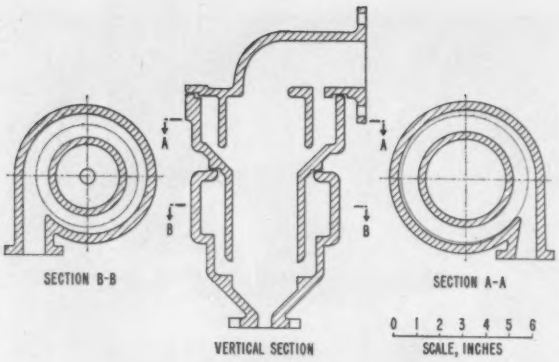
The leveling coat was a mixture of Epon 828 resin with Monsanto Santocel and a silica flour filler. The effect of the Santocel in the mixture is to prevent sagging of the coating on application to vertical surfaces. The curing agent was triethylene tetramine. The leveling coat, which is designed to fill holes and irregularities in the concrete surface, was troweled on to a thickness of ⅛ in. Before the leveling coat began to harden, fiberglass cloth was pressed into it. The fiberglass helps to reinforce the epoxy by distributing stresses; it also leaves a "tooth" for successive coats.

The impregnating coat was brushed on when the leveling coat had become tacky. The impregnating coat consisted of Epon 828, phenyl glycidyl ether (a viscosity depressant), and an altered triethylene tetramine, called Accelerated TTA.

The finishing coat was applied after the impregnating coat had begun to set up—a matter of 1 to 1½ hr. Composed of Epon 828, Santocel and Accelerated TTA, it was troweled on to a thickness of ⅛ in. The coated tanks were allowed to cure at room temperature for 4 hr before being put into use.

Installation time and both installation and over-all costs were considered reasonable, particularly in view of the expensive tanks that the coatings protect.

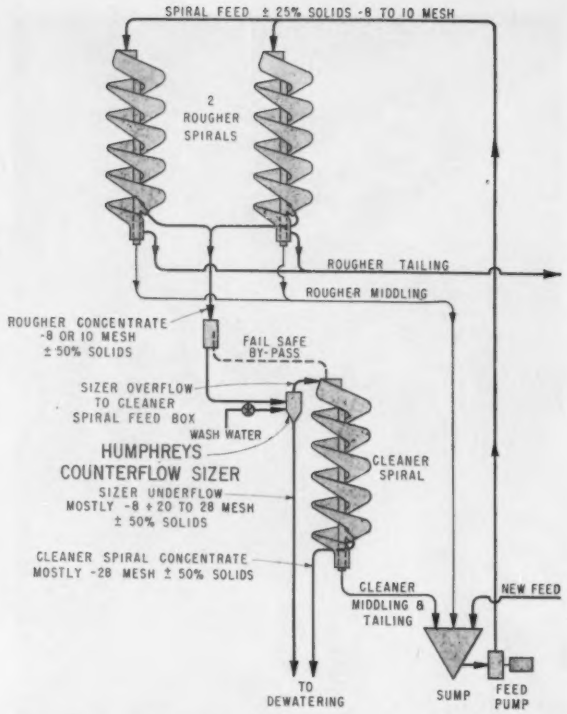
In the conventional two-step refining process, the cells had received adequate protection from the mastic linings formerly used. When the temperature of the cells rose with the new process, the mastic linings ran off, and the acid bath was able to attack the concrete tank walls. Of all the materials that were tested in the attempt to correct this situation, only the epoxy formulation provided satisfactory protection at moderate cost.




**SIMPLICITY OF SIZER** is comparable to that of cyclone. Wash water and feed enter through two tangential openings.

# Counterflow Sizer Benefits Spirals

**JAMES V. THOMPSON**


SPIRAL FEED ± 25% SOLIDS -8 TO 10 MESH
2 ROUGHER SPIRALS
ROUGHER TAILING
ROUGHER MIDDLING
ROUGHER CONCENTRATE -8 OR 10 MESH ± 50% SOLIDS
FAIL SAFE BY-PASS
SIZER OVERFLOW TO CLEANER SPIRAL FEED BOX
WASH WATER
HUMPHREYS COUNTERFLOW SIZER
CLEANER SPIRAL
SIZER UNDERFLOW MOSTLY -8 + 20 TO 28 MESH ± 50% SOLIDS
CLEANER SPIRAL CONCENTRATE MOSTLY -28 MESH ± 50% SOLIDS
CLEANER MIDDLING & TAILING
NEW FEED
TO DEWATERING
SUMP
FEED PUMP

**SIZER'S POSITION** between rougher and cleaner spirals helps in preventing build-up of heavy material in circuit.

PLANTS THAT USE HUMPHREYS SPIRALS can benefit in two ways from a new, simple device, the Counterflow Sizer: higher recovery can be made from coarse feeds, without the need for a jig or a heavy media section; and cleaner circuits can be reduced in size. One large foreign iron ore concentrator is using the Sizer already, and another large iron ore concentrator now under construction will also use it.

I. B. Humphreys and the Humphreys Engineering Co. staff developed and patented the Counterflow Sizer for use in Humphreys Spiral Concentrator circuits. The simple device contains no moving parts, and requires only one control: a pinch valve operating on a small low-pressure water line. Essentially it is a hindered-settling elutriation column similar to a Richards Spitzkasten. Because of the counterflow arrangement, in which the feed enters tangentially in one direction and the wash water in the opposite, the column length is less than would otherwise be required.

There has been some misunderstanding as to the proper application of the Counterflow Sizer. It is used in Humphreys Spiral circuits to treat rougher spiral concentrate ahead of cleaner spirals. It was not designed to replace conventional multiple-pocket sizers used to produce a number of classified spigot products. For any benefit to accrue from the use of the sizer, the rougher spiral feed must contain a significant quantity of coarse liberated heavy minerals in the minus 8 plus 20 to 28 mesh range. If the rougher feed is all minus 20 to 28 mesh, there is no need for the pocket sizer in the circuit.

In a two-stage spiral plant operating on coarse feed involving rougher and cleaner sections, the rougher spiral concentrate is passed through the pocket sizer. The underflow will contain almost pure heavy mineral, coarser than 28 mesh, requiring no further concentration. The overflow will contain only minus 28 mesh heavy mineral and somewhat coarser gangue, which passes directly to the cleaner spirals. Cleaner spiral concentrate then joins sizer underflow as final concentrate.

Mechanically one ideal circuit is two rougher spirals feeding one sizer. The sizer bolts onto the feed box of one cleaner spiral, with rougher spiral, sizer and cleaner spiral stages all arranged for gravity flow. However, other configurations could be devised. The two-stage layout of two roughers, one sizer and one cleaner are set up on a "fail-safe" basis. If the sizer underflow plugs up due to tramp oversize or trash (well designed mills would not have any tramp oversize, but chewing gum, cigarette butts, welding rod ends and match sticks seem to get into all pump sumps), the high level overflow in the sizer feed box by-passes rougher concentrate directly to the feed box of the cleaner spiral. This situation can be tolerated on a few spirals out of hundreds, until the operator can correct the plug-up. The underflow of each sizer is always visible to an operator patrolling the aisle between spirals. Unplugging the sizer requires no tools nor the breaking of threaded pipe connections. It is usually necessary only to remove rubber hoses and shake the contained material into the concentrate launders under the cleaner spirals.

## Why Sizer Is Effective

The following is an explanation of why the pocket sizer works when employed as previously described, on rougher concentrate ahead of cleaner spiral circuits. (James V. Thompson, "The Humphreys Spiral Concentrator," MINING ENGINEERING, January 1958.)

When the rougher spiral feed contains coarse liberated heavy mineral of minus 8 to 20 or 28 mesh, it is possible to recover almost all of this coarse heavy mineral in a rougher concentrate by keeping the feed above 25% solids and using as little wash water as possible. Perhaps the presence of slimes in the rougher feed also assists in the recovery of coarse liberated heavy mineral in the rougher concentrate. Losses of coarse heavy mineral in the rougher

Mr. Thompson is principal engineer with Kaiser Engineers, Oakland, Calif.

stage are due to such particles being swept into the tast tailing water in the outer channel of the rougher spiral, regardless of their size or specific gravity. The rougher stage has no difficulty in disposing of coarse gangue because both size and specific gravity of gangue minerals favor their being swept into the outer tailing channel. However, when the rougher spiral concentrate passes directly to the cleaner spirals, it is difficult to prevent the coarser mineral from being swept into the cleaner tailing. Cleaner tailings are recirculated to rougher feed, and ultimately a buildup of coarse liberated heavy mineral would occur. Eventually the coarse heavy mineral tends to report in the rougher tailing.

The rougher spiral concentrate is made up of all sizes of liberated heavy mineral contained in the feed, but for the most part it contains only minus 20 mesh gangue, the coarser gangue having been readily rejected in the rougher tailing. When this rougher concentrate is subjected to a controlled rising velocity in the sizer, the fine heavy mineral (minus 20 mesh) and all of the gangue overflow to the cleaner spiral feed; and the underflow contains the plus 20 to 28 mesh heavy mineral and almost no gangue. Stripping out the coarse heavy mineral ahead of the cleaner spiral makes it possible to prevent the aforementioned build-up of coarse heavy mineral in the circuit.

### Adjustment a Simple Matter

Adjustment of the Counterflow Sizer is simple. If the operator notes that the underflow of the sizer contains gangue, he increases the wash water until the gangue disappears. Samples of the sizer underflow can be taken with an ordinary household type tea strainer and examined with only a vanning plaque or the palm of the hand. The adjustment, simple though it is, is quite sharp on most ores.

The advantages of the sizer in a two-stage circuit are (1) Higher recovery can be made on coarse feeds. A plant that otherwise might require a small jig section or a heavy media cyclone section can operate 100% on spirals. (2) Cleaner circuits can be smaller, since the heavy mineral is recovered in the sizer following the rougher stage.

One of the first commercial uses of a pocket sizer operating on rougher spiral concentrates in a two-stage spiral plant was installed by the author in 1954, at the Fines Plant of Blythe Manganese Co. in Blythe, Calif. Later this plant was operated for over a year by Aspen Mining Co., a wholly-owned subsidiary of Humphreys Gold Corp., employing the same circuit. In 1954 and 1955 extensive pilot plant tests were conducted at the Mines Experiment Station at the University of Minnesota, employing the two-stage spiral sizer circuit on African iron ore. Large-scale pilot plant tests were also conducted in Canada on iron ores in the summer of 1957 and 1958, employing the two-stage spiral sizer circuit.

There are perhaps many plants operating today that could use the pocket sizer. The author recently observed an iron ore plant employing heavy media cyclones and Humphreys Spirals. The feed was split on screens at about 20 mesh with plus 20 mesh going to heavy media cyclones and the minus 20 mesh to spirals. The reason for the 20 mesh split was that the spirals could not handle coarser feed. By employing the pocket sizer in the circuit the screens could be opened to handle 8 or 10 mesh; and the spiral circuit could handle the additional tonnage, probably without any increase in the number of spirals. This would probably result in a saving in screening costs and a general over-all increase in plant efficiency.

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# What's Your Silicosis I.Q.?

## Test yourself with questions asked and answered in the up-to-date silicosis prevention booklet available from McIntyre Research Foundation

OVER FIFTEEN YEARS AGO, the McIntyre Research Foundation published a booklet for the layman entitled "Silicosis—what it is and how it can be prevented." That 20-page booklet, still interesting and informative, has been brought up to date and is available for general distribution from the Foundation, Suite 1500, 25 King St. West, Toronto 1, Ontario.

The booklet was prepared primarily for the information of those who are receiving regular inhalations of McIntyre aluminum powder, but should prove interesting to anyone concerned with silicosis and its prevention. McIntyre aluminum powder cannot be regarded as a "cure" for silicosis since it will not restore normal lung tissue which has already undergone fibrotic change; neither is it a substitute for proper measures designed to control the production of silica-bearing dusts and the elimination of that dust from the atmosphere.

The booklet explains the use of aluminum powder and answers many questions which are often asked in regard to aluminum powder and silicosis therapy. For example:

**Q.** How many individual aluminum powder treatments have been administered by 1959? **A.** Over 110-million.

**Q.** Has anyone ever been harmed by taking aluminum powder as a preventive against silicosis? **A.** No.

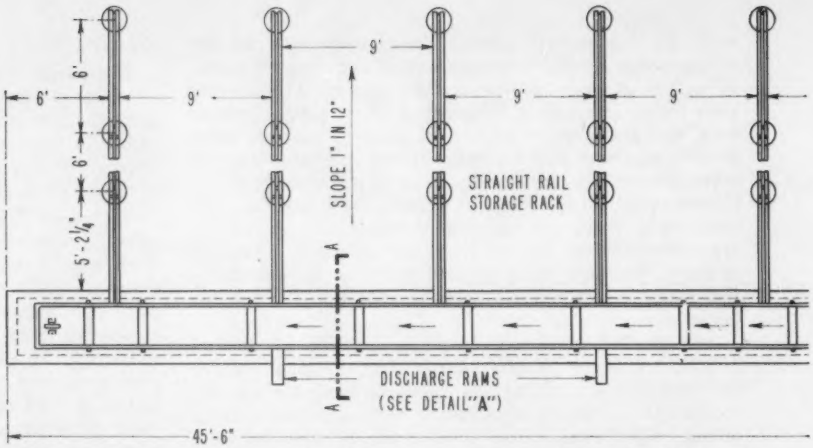
**Q.** Will aluminum powder aggravate stomach ulcers? **A.** No. **Q.** Tuberculosis? **A.** No, based on experimental work in animals and on observations of humans.

**Q.** Will silicosis lead to tuberculosis? **A.** No. Tuberculosis is a contagious disease and only can be developed by contact with a person who has tuberculosis.

**Q.** Will the scars of silicosis disappear after aluminum-powder treatment? **A.** No. **Q.** Will aluminum powder treatments cover the scars due to silicosis so that future x-ray of the chest will not show the scars? **A.** No. Aluminum powder has no affect on x-ray films.

**Q.** Does a person with silicosis have the same degree of natural protection against tuberculosis as the non-silicotic? **A.** No. Persons with silicosis should stay away from those having active tuberculosis. **Q.** What is the McIntyre Foundation? **A.** McIntyre Research Foundation is a non-profit group dedicated to the eradication of silicosis and will cooperate with any other agency or body interested in industrial health.

# An Efficient Rail Straightener Installation




**RAILS MOVE** from right to left by means of cables which are hooked on the rails

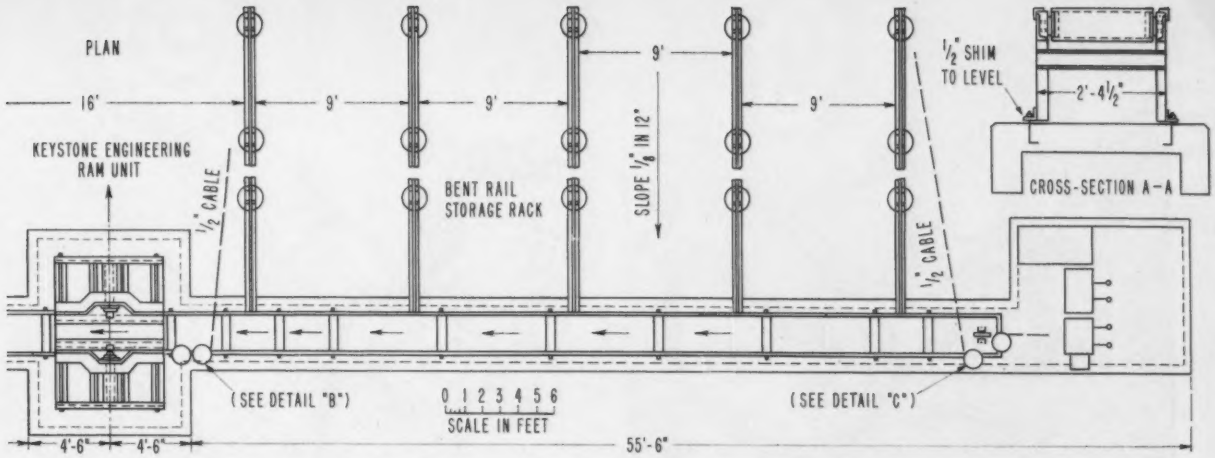
EQUIPMENT that has speeded up the task of straightening bent rails and has made it a safer and cheaper operation is the novel straightener assembly in operation at the New Cornelia Branch of Phelps Dodge Corp. As built, the assembly represents a modification of one in use at the Morenci branch of the company and the design combines ideas of the Morenci and New Cornelia (Ajo) engineering departments and Keystone Engineering Co. of Los Angeles. In periodic use in the mine yard near the large open pit, the unit is served by a spiral and switchback rail system. Outstanding design features of the assembly are control of all operations from one central point and mechanical handling of rails from the storage rack for bent rails onto the roller track; through the rail straightener proper, and then onto the storage rack for straightened rails.

The rail straightener assembly consists of a Keystone Engineering hydraulic straightener unit, roller tracks extending from the feed and discharge ends, a horizontal storage rack for bent rails situated along the feed end roller track, and an incline storage rack for straightened rails along the discharge end roller track. Both rail storage racks are made from 90-lb rails. Movement of rails from the bent rail storage rack onto the feed roller track, through the straightener unit, and finally onto the discharge roller track is accomplished by cables with appropriate hooks and actuated by a 5-hp I-R double-drum hoist through a series of ingenious sheave arrangements explained in detail in the accompanying drawing. Of interest also are the two rail discharge rams installed at strategic points along the discharge end roller track. These, as well as the roller tracks, and rail storage racks, are of local design. The discharge rams push with minimum delay each straightened rail from the roller track onto the incline rail storage rack, where a yard hoist transports the rails either direct to the track panel assembly area or stacks them in a near-by storage yard.

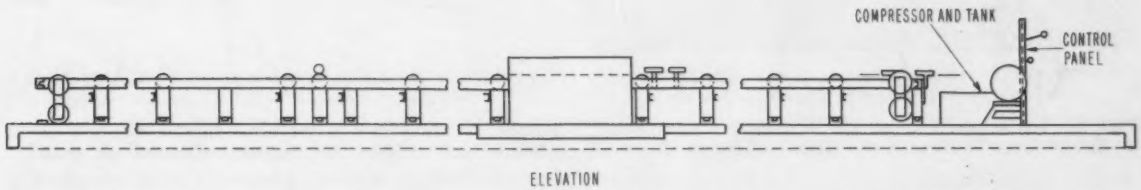
**AS SEEN FROM THE OPERATOR'S END,** the unit contains home-made (from 90-lb rail) storage racks and level rollers. Ram straightener is at upper right.

**RAILS ARE STRAIGHTENED** in ram unit located between the two storage racks as they are pulled over the rollers. The operator's view is along the rail length.

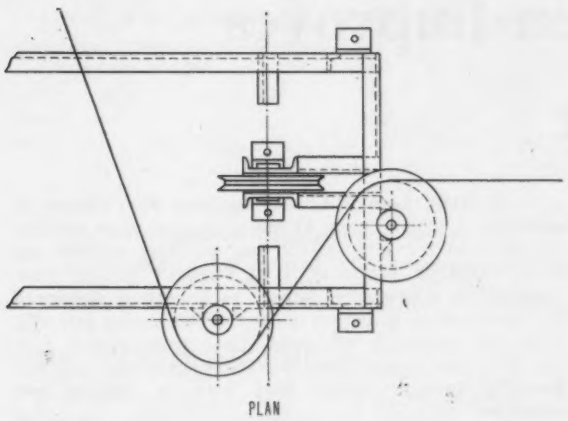
All operations—moving rails to the straightener unit, straightening the rail while passing through the straightener unit, and pushing straightened rails onto the incline storage rack — are controlled from a roofed central control room which houses the control panels, double-drum hoist, and the hydraulic pump assembly serving the straightener unit. The room is at the feed end of the roller track, permitting the operator to observe rail moving and straightening operations at all times.

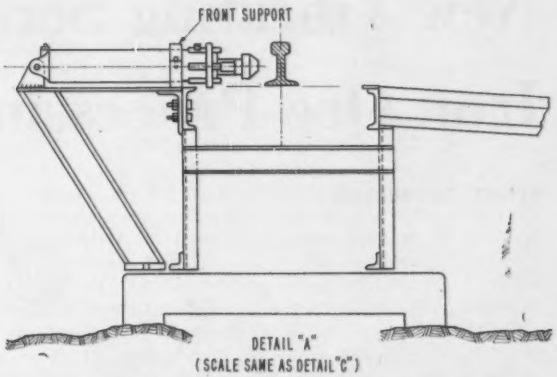



at the bent rail storage rack. The rails are pulled onto the rollers, through the ram, and onto the straight rail storage rack.

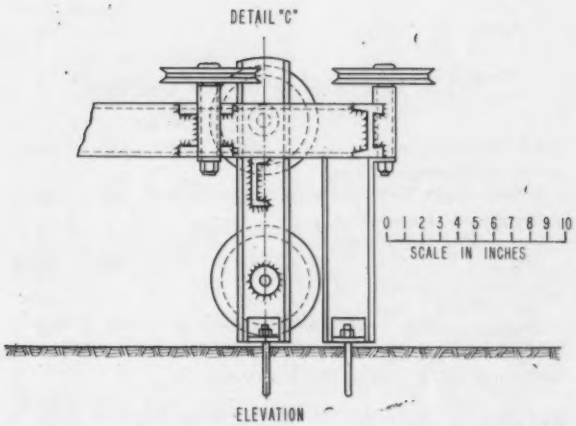



**ALL OPERATIONS** are seen from a roofed central control room which houses the controls, hoist, and hydraulic pump assembly.

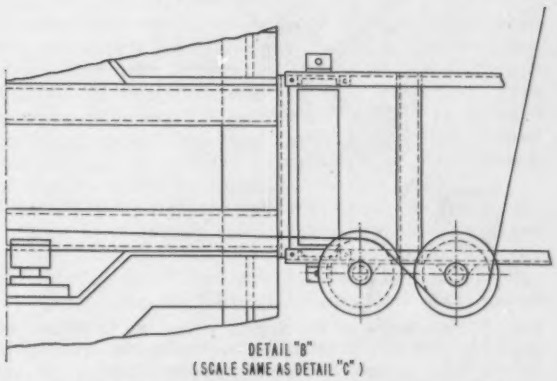



**DISCHARGE RAMS** speedily push rails onto inclined storage rack, where a yard hoist removes them for mine service.




**SHEAVE ARRANGEMENT** on the operator's side permits the ½-in. cable to be extended to the bent rail storage rack.




**ON THE RAM'S SIDE,** sheave arrangement permits the bent rails to be pulled onto the rollers from the storage rack.

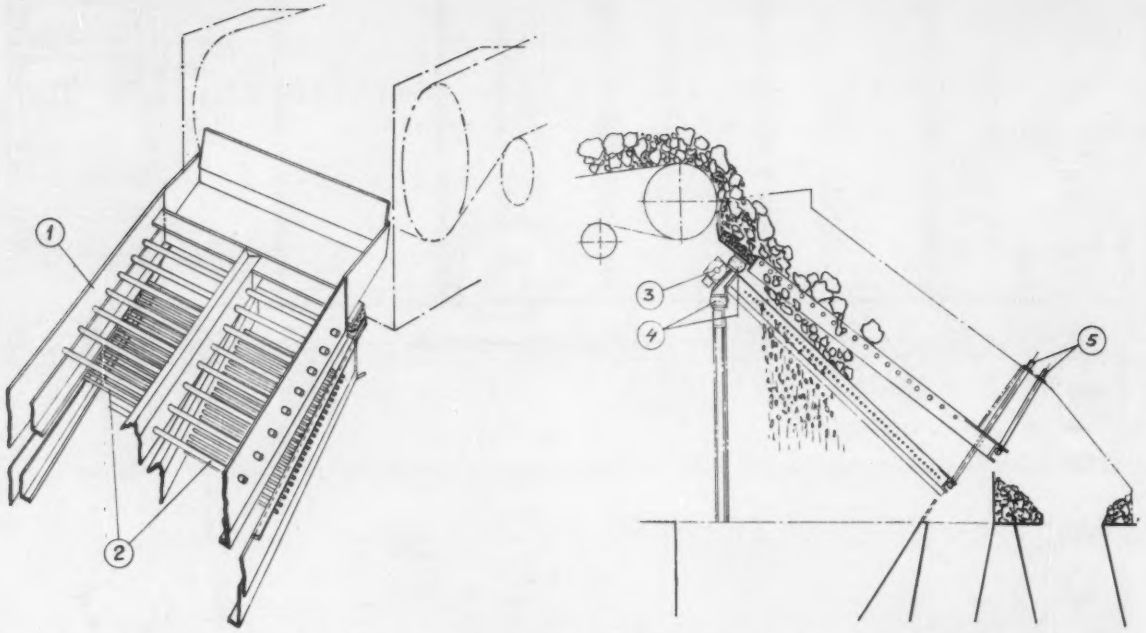



**FIG. 1.** Parts of the L-screen are as follows: (1) framework, (2) screen rods, (3) vibrator, (4) rubber buffers, (5) set screws. Binding by sticky fines is prevented because rods are set in vibration and rotation. Rubbing action breaks the oversize.

# New Vibrating Screen Improves Iron Ore Processing

**BENGT FAGERBERG**

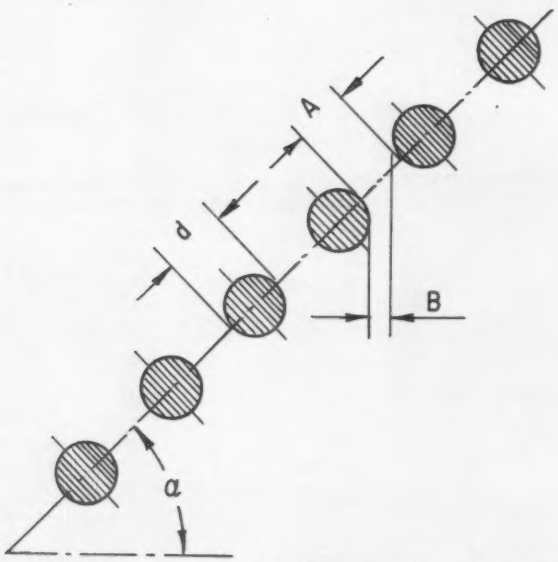



**FIG. 2.** Dimensions of the sloping screen are as follows (α) slope angle, (d) rod diameter, (A) nominal screen opening, (B) effective screen opening.

Mr. Fagerberg is on the staff of Luossavaara-Kiirunavaara Aktiebolag (LKAB), Malmberget, Sweden.

In 1958-59, Luossavaara-Kiirunavaara Co. altered its central dry cobbing plant at Malmberget to meet increasing demand for high grade, iron ore-fines suitable for strand-sintering. Previously used vibratory screens were replaced by a new type, known as L-screens, developed by the company to permit a simple, inexpensive and efficient dry screening of moist fines from coarse iron ore. The new screens have worked successfully and will probably become widely used both in Sweden and elsewhere.

**Table 1. Efficiency of the L-screen at different feed rates.**

| | | | | | |
|---|---|---|---|---|---|
| Feed rate metric tph..... | 100 | 150 | 250 | 350 | 500 |
| Amount of material—3 mm in feed weight %..... | 55.5 | 55.5 | 55.5 | 55.5 | 55.5 |
| Screened off material—3 mm weight % of total feed..... | 47.4 | 48.1 | 50.5 | 50.7 | 50.8 |
| Efficiency — recovery of material — 3 mm in screened off lines..... | 85.5 | 86.7 | 91.0 | 91.4 | 91.5 |

Ore: Malmberget GD
Amount of decks: 2, each 1200 x 3200-mm

| | Upper deck | Lower deck |
|---|---|---|
| Rod dia, mm..... | 25 | 10 |
| Distance between rod centers, mm.. | 95 | 18 |
| Slope of decks..... | 45° | 45° |

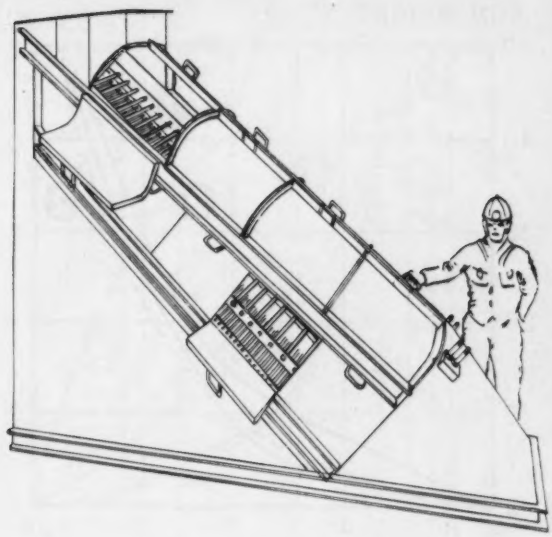


FIG. 3. L-SCREEN is enclosed in a housing equipped with hinged hatches for inspection and replacing rods.

FIG. 4. Double-decked L-screen installed in central dry cobbing plant at Malmberget screen coarsely-crushed ore.

**Table 2. Operating costs for L-screens and for previously used vibratory screens at Malmberget**

| Costs factor in Sw. ore per ton | Previously used vibratory screens type 1 | Previously used vibratory screens type 2 | L-screens |
|---|---|---|---|
| Material and labor for maintenance of screening surfaces | 0.80 | 0.77 | 0.26 |
| Various repairs | 0.24 | 0.12 | 0.04 |
| Electric power | 0.06 | 0.05 | 0.004 |
| Total costs | 1.10 | 0.94 | 0.30 |

**Table 3. Service life of rods and rod holders in L-screens under present-day conditions at Malmberget**

| Service life, hours | Upper deck | Lower deck |
|---|---|---|
| Rods | | |
| upper part of deck | 1600 | 900 |
| central part of deck | 2300 | 800 |
| lower part of deck | 3250 | 1100 |
| Rod holders | | |
| side frames | 3800 | 1100 |
| central beam | 3800 | 1400 |

Ore: Malmberget GD
Rod diameter: upper deck 25 mm, lower deck 10 mm
Material in rods and bearings: carbon steel
Total feed rate: 200–300 tph per screen.

**Table 4. Specifications for screen shown in Fig. 4**

| | Upper deck | Lower deck |
|---|---|---|
| Width of screening deck, mm | 1200 | 1200 |
| Length of screening deck, mm | 3200 | 3200 |
| Distance between rod centers, mm | 95 | 18 |
| Rod diameter, mm | 25 | 10 |
| Rod length, mm | 660 | 660 |
| Slope angle | 45° | 45-48° |

Vibrator effect: 0.3 kw
Manufacturer: Arbrå Verkstads AB, Arbrå, Sweden.

## Purpose of L-Screens

In the L-screen the decks consist of parallel, transverse rows of round rods, inserted in holes drilled in the side-plates and central beam of the sloping, rectangular framework. (Fig. 1.) The rods have a somewhat smaller diameter than the holes in the side frames. Thus rods can move freely in their mountings, when set in motion by means of a vibrator. At the feed end, decks are placed on rubber buffers. At the discharge end, they are suspended in easily accessible set screws by which the slope can be adjusted to suit the properties of the feed and the desired screening.

Ore to be screened is fed to the top of the screen and gravitates down the decks. Finer material is then removed by passing through the slots between the transverse rods. Blinding by sticky fines is prevented because the rods are set in vibration and rotation by the previously mentioned vibrator, and by the rubbing action of oversize particles. Another important factor that prevents wedging and permits fine-grained products to be screened off is that only some of the particles of the same size as the slot width are able to pass between the rods. This is illustrated by Fig. 2, where the nominal and effective screen openings are marked A and B, respectively. The effective opening decreases with increased screen slope and is always smaller than the nominal. In principle, the effective opening determines the size of the screened fines as these attempt to pass through the rod slots vertically to the horizontal plane. Obviously, some pieces of critical size and shape will become wedged between the rods temporarily. Such particles, however, will be removed rapidly, by material rushing down the decks, or they may be turned so they pass through the slots and then report as a minor amount of oversize within the range A-B in the fines.

Usually the L-screen is built with two decks. It is totally enclosed in a housing, which eliminates dust, noise and spillage from the exteriors. Individual screen rods are easily removed for replacement after hinged side hatches are opened (Fig. 3). When these are closed, the rods are held securely in position, to prevent lateral motion.

Eleven L-screens are installed at Malmberget (Fig. 4) for dry screening of coarse-grained, mostly friable magnetite and hematite ores with a top size of about 150 mm (Fig. 5). Moisture content is normally about 2%, but occasionally it can rise to 3-4%

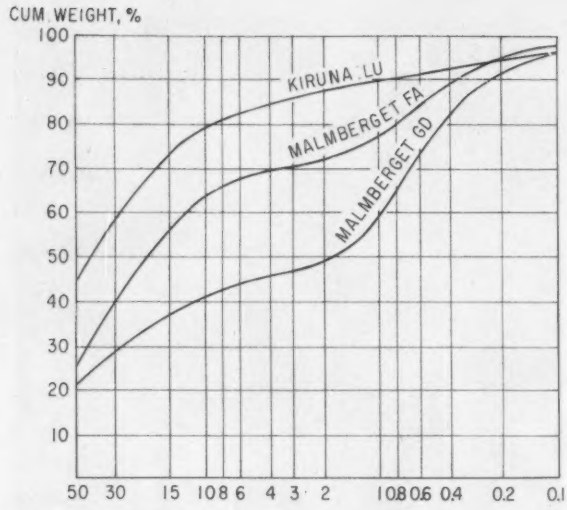



**FIG. 5.** Screen analyses for three ores treated on L-screen.

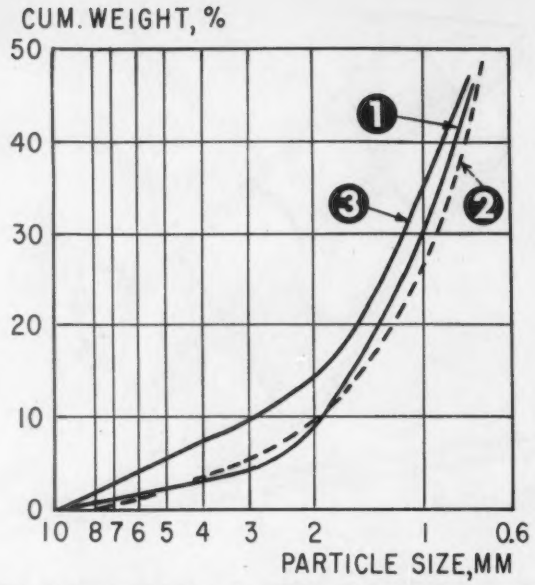



**FIG. 6.** Variation in slope changes the product of the L-screen. Distance between rod centers, lower deck was 18 mm. Rod diameter of lower deck was 10 mm. Slopes were as follows: (1) 41°, (2) 44°, (3) 48°, (4) 52°, (5) theoretical screen analyses at 100% of undersize through 1-mm square meshes.

Screening serves two purposes:

(1) To divide ores into three fractions, —10, 10-50 and +50 mm, for separate treatment by different cobbing methods. Here it is of utmost importance that the fines be removed effectively from the coarser fractions.

(2) To obtain a fine-grained product suitable for strand-sintering. This material should not be coarser than approximately 10 mm and should contain as few particles as possible in the size range 3-10 mm, preferably not more than 10% by weight.

In the LKAB cobbing mills at Kiruna a number of L-screens are used for similar purposes as in Malmberget. In these plants the ores treated are somewhat harder and more fine-grained than those at Malmberget (Fig. 5). L-screens are also in operation in a Swedish steel mill and in several crushing plants producing road material. In general, L-screens can be used wherever it is not essential to screen on cloth or perforated plates.

L-screens installed at Malmberget and Kiruna have proved to be far superior to the formerly used vibrating screens.

## Blinding Is Reduced

The main disadvantage of the former vibrating screens was that they could not be used for fine sizing. When the ores contained more than 1.5% moisture, troublesome blinding took place, leading to low efficiency at 15 mm screen openings. Cleaning of the screen-cloth was tedious and difficult. Various types of plate and wire screen surfaces with round, square and rectangular openings were tested. The most efficient screening was obtained with long slot space screens; but as the screen cloths were worn out after a total feed of only 13,000 tons, the maintenance costs were excessive and the stoppages for replacement of cloths too frequent.

When L-screens are used, no difficulty will normally be experienced in separating minus 10-mm fines, provided the slope of the screen decks at least equals the angle of repose of the feed material. Otherwise large particles will wedge between the screen rods and then pile up until the angle of repose is obtained. At Malmberget, minimum permissible slope angle was found to be about 40°, but in practice larger angles are used.

Blinding phenomena may occur with ore of high moisture content, if the ore also contains clayey substances that stick to the screen rods. At Malmberget for high-grade ore assaying about 50% Fe and with low clay content, the maximum tolerance in moisture content is about 3.5%. At Kiruna, ores with 50% Fe and 3.7% moisture can be screened satisfactorily. If blinding occurs, the L-screens are easily cleaned because the decks are accessible from all sides.

Size of the screened fines should, in theory, decrease with increased slope of the screening surface, although a certain amount of particles of the same size as the nominal screen opening may pass through the rod slots. Tests have shown that this holds true in practice. In the special case illustrated in Fig. 6, the amount of plus 3 mm particles in the fines decreased from about 8% at a slope of 44° to about 4% at a slope of 48°. A further increase of the screen inclination did not improve the results.

This example as well as the data in Fig. 7 clearly demonstrate that the L-screen produces fines of a size distribution suitable for strand-sintering. Generally speaking it has been found, that 20-40% by weight of the total amount of 3-10 mm particles in the feed report to the fines when the screening is performed on decks with 48° slope, 10-mm dia rods and 8-mm nominal slot width. The amount of 8-10 mm oversize is negligible and consists mostly of flat particles.

The L-screen performs well at very high feed rates (Table 1). This is probably because screen rods will vibrate more intensively when the load increases and thus more fine material will have a chance to pass between the rods.

Maximum permissible feed rate depends upon the character of the material to be screened. At Malmberget the L-screens, 1200 x 3200-mm, can conveniently handle 500 tph of ore with about 55% minus 3 mm. Efficiency according to the definition given in Table 1 will then be about 92%. Previously used vibrating screens with approximately the same screen area as the L-screens were unable to treat more than 300 tph.

## L-Screens Operate Economically

A comparison between the operating costs for the previously used vibratory screens and the L-screens now in-

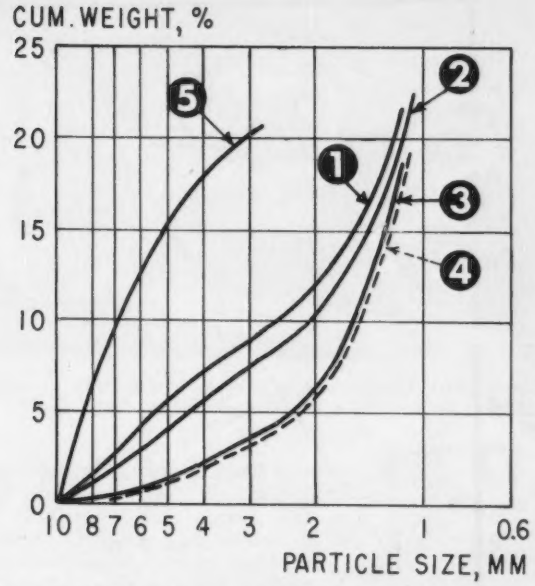



**FIG. 7.** Variations in screen analyses with different feed rates to the L-screen. The ore was Malmberget GD. Distance between rod centers, lower deck, was 18 mm. Rod diameter of lower deck was 10 mm. Rates were as follows: (1) 250 tph, (2) 500 tph, (3) theoretical screen analysis at 100% recovery undersize through 10-mm square meshes.

stalled at Malmberget is given in Table 2 which shows that L-screens are cheaper mainly because of lower costs for maintenance of screen decks. This in turn is due to the following factors:

(a) The costs of the screening medium per square centimeter of screening area are lower for L-screens.

(b) The screening medium is utilized better in the L-screens, as the rods are worn around their periphery and can be replaced individually when necessary.

(c) The screening medium in the L-screens is readily accessible and can be replaced rapidly by unskilled laborers.

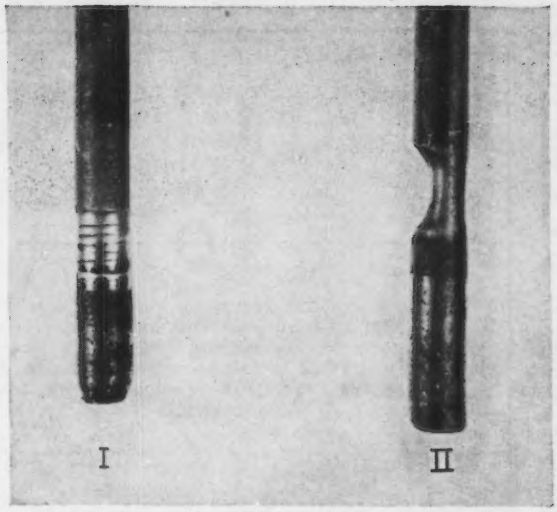



**FIG. 8.** Wear on screen rods (I, mounted in trekollan holders; II, mounted in steel holders): Rod dia, 10 mm; material in rod, carbon steel; operating time per rod, 884 hr.

Investigations are now in progress aiming at further improvement of the operating economy of the L-screens. Firstly, different materials for rods and rodholders are tested. Approximate life of these parts under present-day conditions at Malmberget are shown in Table 3.

If rods and holders are made of steel, the wear on both is rather severe. In most cases, such wear is the reason why otherwise fully serviceable rods have to be replaced. For example, the decrease in diameter of a 10-mm rod after 884 hr of operation amounted to 1.19 mm at the center of the rod and to 2.34 mm at its supported points. Wear will be considerably reduced and far more evenly distributed, if the holders are made of smooth, hard rubber. Favorable results have been obtained with a synthetic rubber of polyurethane type, called trekollan (Fig. 8). With holders made of this material, lifetime of rods is trebled.

# Detergent Aids Blasthole Drilling

AN INNOVATION at some of the large open pits in Arizona recently visited by E&MJ and watched with interest by mining men is the use of detergent in drilling large diameter blastholes. Experiments employing the method have been underway for a considerable time at Silver Bell, Pima, Ajo, and other mines. Data collected so far indicate that the procedure offers several operational advantages at a relatively low cost.

The results obtained at the Oxide and Tiro pits of American Smelting & Refining Co. at Silver Bell, near Tucson, may be of interest. Here, two types of prophyry are mined—alaskite, which is hard, and dacite, which is relatively soft, influencing drilling speeds and techniques to some extent. Drilling of the 47- and 50-ft blastholes is carried out with a B-E 40-R rotary drill using 9-in. Tricone type bits.

The drill is equipped with a steel tank which holds the water-detergent mix and a small piston type pump injects the mix from the tank into the bottom of the air line stand pipe, which extends up the mast. Introduction of the mix at this point has practically eliminated creation of dust in the cutting zone proper. The mix reaches this area in a foamy state, thereby thoroughly wetting the drill chips produced by the bit. Amount of detergent added to each 100 gal of water varies from 1 to 1½ lb. The detergent known as HD-90 is supplied by the Braun Chemical Co.

Daily cost averages about 40c and footage drilled per shift averages 350 ft. Results of drilling with detergent and with water only in hard ore at the Oxide and Tiro pits are given in the accompanying table:

**Tiro Pit (drill equipped with ammeter)**

| | RPM | Gage pressure | Amp |
|---|---|---|---|
| With water only..... | 61 | 900 | 60 |
| With detergent..... | 68 | 900 | 45 |
| | 60 | 1100 | 50 |

**Oxide Pit (drill not equipped with ammeter)**

| | | |
|---|---|---|
| With water only..... | 60 | 1050 |
| With detergent..... | 67 | 1050 |
| | 59 | 1350 |

Advantages gained through use of detergent include: (1) faster rotation under maximum pressure with an estimated increase in penetration of 10%, (2) increase in life of retipped bit of from 400 to 500 ft, and (3) improved dust control with lower water consumption. When drilling with water only, the amount of water consumed for drilling 350 ft of hole per shift is nearly 200 gal. With detergent this figure is 120 gal, and one water service per shift, instead of two, when drilling with water only.

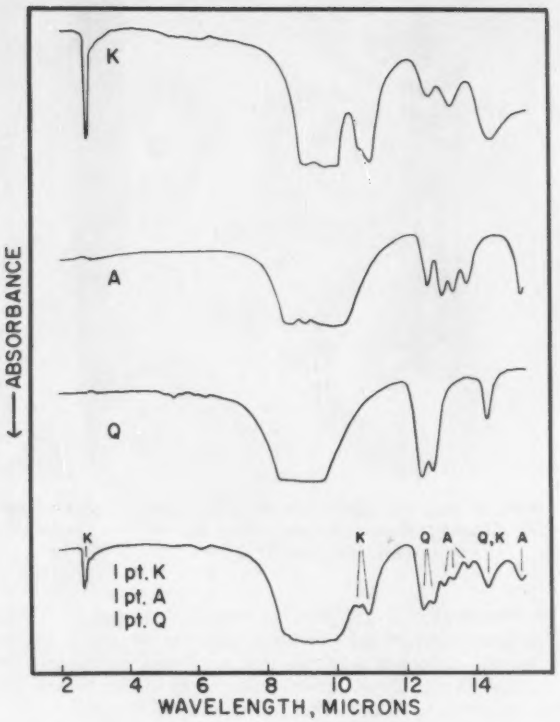



**FIG. 1. Mineral identification** with infrared. Absorption curves of kaolinite (K), albite (A), quartz (Q), and a mixture of the three minerals.

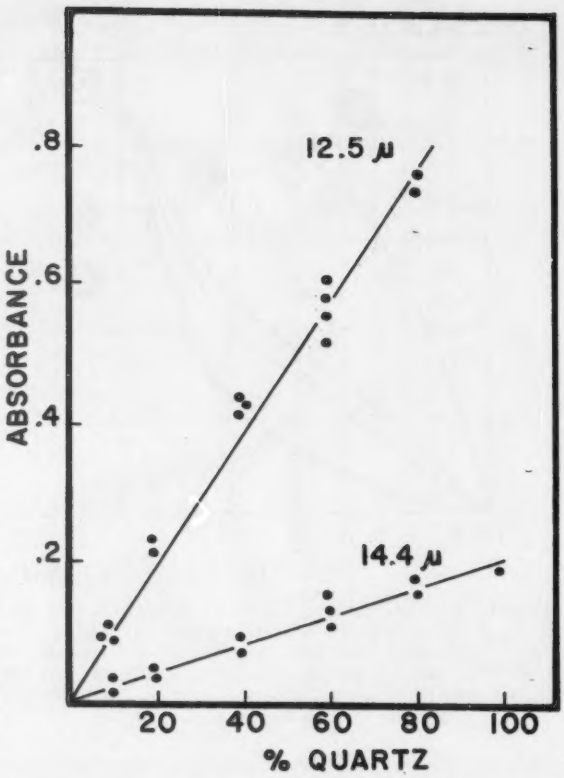



**FIG. 2. Quantification** with infrared. Calibration curve relating strength of two separate absorption bands (12.5 and 14.4 microns) to the percentage of quartz in the sample.

# Infrared Analysis Is Quick & Easy

**W. M. TUDDENHAM**

**S. R. ZIMMERLEY**

FOR FIVE YEARS, on analytical problems ranging from exploration to finished copper, Kennecott's Research Center has used the infrared spectrophotometer. It has proved itself to be both quick and easy to use.

Organic chemists have known for a long time how valuable the infrared spectrophotometer can be for structural studies and analysis. Mineralogists have started to use it more recently, and have not fully exploited it. Perhaps the reason why development in this field has been slow is that the instruments have been expensive.

Several companies have recently developed moderately-priced infrared instruments; this should lead to wider use of the method. With this in mind, this article gives examples which show the use of infrared techniques throughout the mineral industry, from exploration to finished product.

Mr. Zimmerley is director of research and Mr. Tuddenham is senior scientist at Kennecott Research Center, Salt Lake City, Utah.

Among the many workers in the field who have discussed the fundamentals of the infrared method of analysis, Williams, in 1948, gave a good general coverage.[5] The wave lengths at which radiation is absorbed in the infrared region (8000 to 3-million angstroms) can be related to the interatomic vibrations in a molecule or crystal. Thus infrared measurements have definite theoretical significance. But their widest application to date has been empirical. Because vibrations within the molecule are related to the frequencies absorbed, no two compounds give exactly the same pattern when transmission of radiation is plotted against wave length. Fig. 1 gives the infrared curves for kaolinite, albite and quartz, as well as for a 1:1:1 mixture of the three. Not only does each of the three minerals give a distinctly characteristic pattern; but, also, the absorption curve of the mixture shows the features of each. Too, the depth of an individual absorption band can be related to the concentration of the material responsible for it; therefore, the method is suited for quantitative work. Fig. 2 gives a calibration curve that relates absorbency to percentage of quartz for two wave lengths.

## Instrumentation and Sampling

Several companies manufacture instruments capable of handling the problems described below. Most instruments now in use depend on a sodium chloride prism to disperse the radiation; thus the most commonly used wave length range is from about 2 to 16 microns (20,000 to 160,000 angstroms). Longer wave lengths from other prism materials, such as potassium bromide, also give interesting results. The instrument that performed the work described below used a sodium chloride prism. Fig. 3 shows the infrared equipment now in use at the Kennecott Research Center.

Samples for infrared analysis can be in the form of thin liquid films, thin deposited films, solutions, or solid suspensions. The method depends on the material in question. The development of the so-called potassium

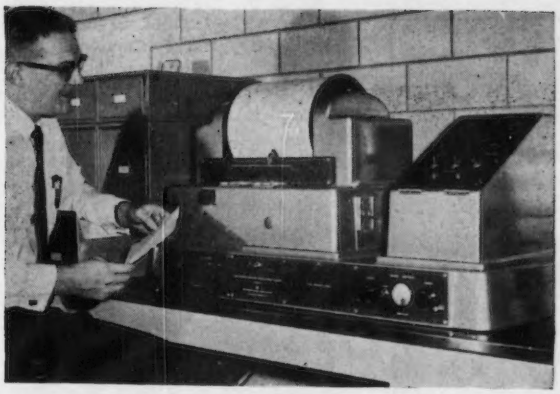


**FIG. 3. This infrared analyzer,** using a sodium chloride prism, gave the results described in this article.

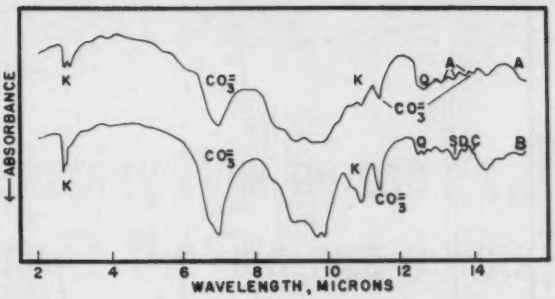



**FIG. 4. Alteration studies** with infrared. Absorption curve **A** shows presence of 20% kaolinite (K), 25% albite (A), 25% quartz (Q), and 20% calcite ($CO_3$). Curve **B,** for a 3-mg sample from a thin vein crossing rock **A,** shows 34% kaolinite (K) and 40% quartz (Q); siderite (S), dolomite (D), and calcite (C) make up a total of about 25% $CO_3$ in the sample.

bromide pellet method, which was described independently by Stimson and Schiedt in 1952,[2,3] should lead to greater application of infrared analysis to mineral industry problems. In this technique, a small amount of the fine-ground sample is suspended in potassium bromide, and about 65 psi pressure is applied in an evacuated die. Since potassium bromide has no absorption spectrum in the region of interest, the resulting clear or translucent disk yields an absorption curve that is characteristic of the sample. In this way, excellent absorption spectra of minerals can be obtained with potassium bromide disks containing about 0.25% of the sample in question.

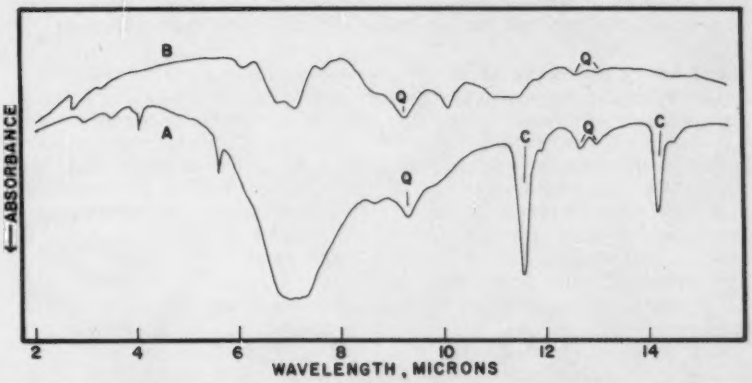



**FIG. 5. Controlling kiln operation** with infrared. Absorption curve **A,** of limestone specimen, shows presence of 4% quartz (Q). Curve **B** is completely-calcined product from **A.** (C) indicates diagnostic bands for calcite.

## Application in the Mineral Industries

In a five-year period at the Kennecott Research Center, infrared techniques have been applied to problems in every phase of operations, from exploration to finished product. Some of the problems were directly applicable to copper production; others were of more indirect importance. Here are several examples that illustrate the application of infrared methods to the copper and other mineral industries.

**Exploration.** In finding new economic mineral deposits, we must use many approaches. One important approach is based on study of mineral alteration in areas surrounding orebodies, since bleached and altered areas are important clues to the presence of sulphide mineralization. Geologists often use these "halos" of altered rock to determine drilling sites; but to make best use of the alteration "halo," they must map the degree of alteration in detail. These mineral changes are often hard to follow with conventional microscopes, and special techniques must be used. The infrared method has been shown to be especially valuable in this respect.[1] Fig. 4 shows the infrared curve of an altered rock in which the minerals were so fine-grained that accurate optical estimation of their relative concentrations was impossible. With infrared, it was easy to identify the important minerals and to measure their amounts, as shown.

Sometimes, in exploration work, it is necessary to make a direct determination of an economically important mineral. If one were looking for raw material for lime burning, it would be a great help to be able to distinguish easily between various carbonates, as in Fig. 4. Other valuable minerals that can be easily identified by their infrared spectra are kaolinite, halloysite, dickite, gypsum, beryl, montmorillonite, feldspars, quartz, barite, talc, muscovite and borates.

**Raw materials.** Quality control of raw materials is fundamentally important in any process. Feed for a lime kiln is a good example. Here, silica can be harmful, and it is valuable to have an easy method of estimating the silica content of limestone, as well as the presence or absence of carbonates other than calcite. Infrared examination can easily and readily determine these. Fig. 5(A), for example, gives the infrared absorption curve of a limestone specimen containing less than 5% quartz.

In like manner, many other prime raw materials, such as gypsum, halloysite, alunite, or barite, can easily and accurately be checked for quality before they enter a process.

**Process control.** Not all important materials in the mineral industries are inorganic. Many times a process succeeds or fails because of the use or misuse of organic reagents. In beneficiation, flotation reagents are of basic importance, and control of their quality is vital. Fig. 6 illustrates a problem involving a flotation agent that was solved by an infrared study. Here, a commercially-prepared batch of reagent was found to be inferior to that previously used. The active ingredients were extracted from each preparation and analyzed. The commercial preparation (Fig 6[B]) con-

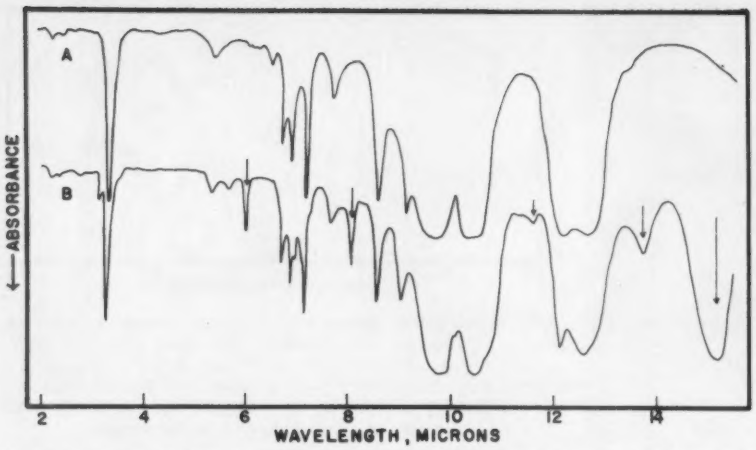



**FIG. 6. Testing of flotation reagents** with infrared. Absorption curve of the extract from commercially-prepared flotation reagent **(B)**, compared with pure compound **(A)**.

tained less of the active agent (Fig. 6[A]) than the standard material. The spurious absorption bands (at 6.1, 8.2, 11.6, 13.8 and 15.2 microns) show the presence of impurities in the commercial product. It took only a small amount of time to gather these data, compared with that which a conventional analysis would have required. This result gave a quality-control procedure that could serve on a routine basis.

Two other examples directly important to Kennecott involved studies of fluxing materials and of the failure of furnace linings.

In calculating the amount of flux to be added to a charge during smelting, it is vital that the operator know the amount of active ingredient that the fluxing material contains. For silica flux, the percentage of available silica must be distinguished from that which is not available for reaction because it is tied up in silicates. Infrared analysis quickly and accurately does this, so it is often employed to check the quality of fluxing materials.

In an infrared study of furnace lining failure, it was found that a brick with forsterite ($2MgO.SiO_2$) as a constituent reacted with the iron in a charge to form fayalite ($2FeO.SiO_2$). This change lowered the melting point of the material from 1890°C (melting point of forsterite) to 1205°C (that of fayalite). Probably, this caused the fusion failure of the brick.

**Finished product.** The burning of limestone to yield lime is an excellent example of infrared use to control the quality of a final product. It is possible to follow the conversion of calcite to calcium oxide accurately and easily, by examining samples taken at various intervals during the process. Fig. 5 gives infrared curves for the furnace feed (A) and for a completely calcined product (B). By measuring the depth of the absorption band at 11.5 microns or that at 14, we can easily determine the percentage of calcite that remains at any time. A similar technique has been used in determining the percentage of $CO_2$ remaining in carbonate apatite samples after ignition at various temperatures.

**Industrial hygiene.** Dust hazards, especially from silica dust, are always present in mining and milling operations. We ordinarily determine the silica content of dust samples either by counting techniques or by chemical dissolution. These methods are tedious, so an investigation was made to see if we could use infrared analysis to determine quartz in industrial dust samples.

Table I gives the results obtained from analyzing five different dust samples, of widely varying origin, by both the infrared and the chemical methods.[4] We know that when samples contain very finely divided quartz, the chemical results may be low. Noting that samples A, B, and D contain relatively high amounts of minus-5-micron material, we find that the results substantially agree.

An important point to note here is that the infrared method distinguishes positively between quartz and silicate minerals. On the other hand, the chemical method depends on differential solubility of the mineral types; it is, therefore, somewhat less definitive. The speed and reliability of the infrared determination of quartz recommend it for serious consideration in industrial hygiene.

The examples given here, illustrating the utility of infrared analysis in the fields of exploration, raw materials, process control, finished product, and industrial hygiene, make up only a short list. They serve to indicate how wide a range of problems the method may help to solve; numerous other particular examples could be cited.

## Conclusion

The foregoing discussion does not intend to propose that infrared methods are a panacea for all mine, mill or smelter work. No instrumental method yet found will solve all of the analytical problems found in any one of the mineral industries. Classical methods are still a mainstay, particularly for accounting purposes. In work at the Kennecott Research Center, however, enough problems like the ones above have been solved by infrared that we rely heavily on it to solve day-to-day problems. Judging from our experience, other groups in the field ought to be able to use infrared methods in their daily operations. The coming of moderately-priced instruments should stimulate this work.

## References

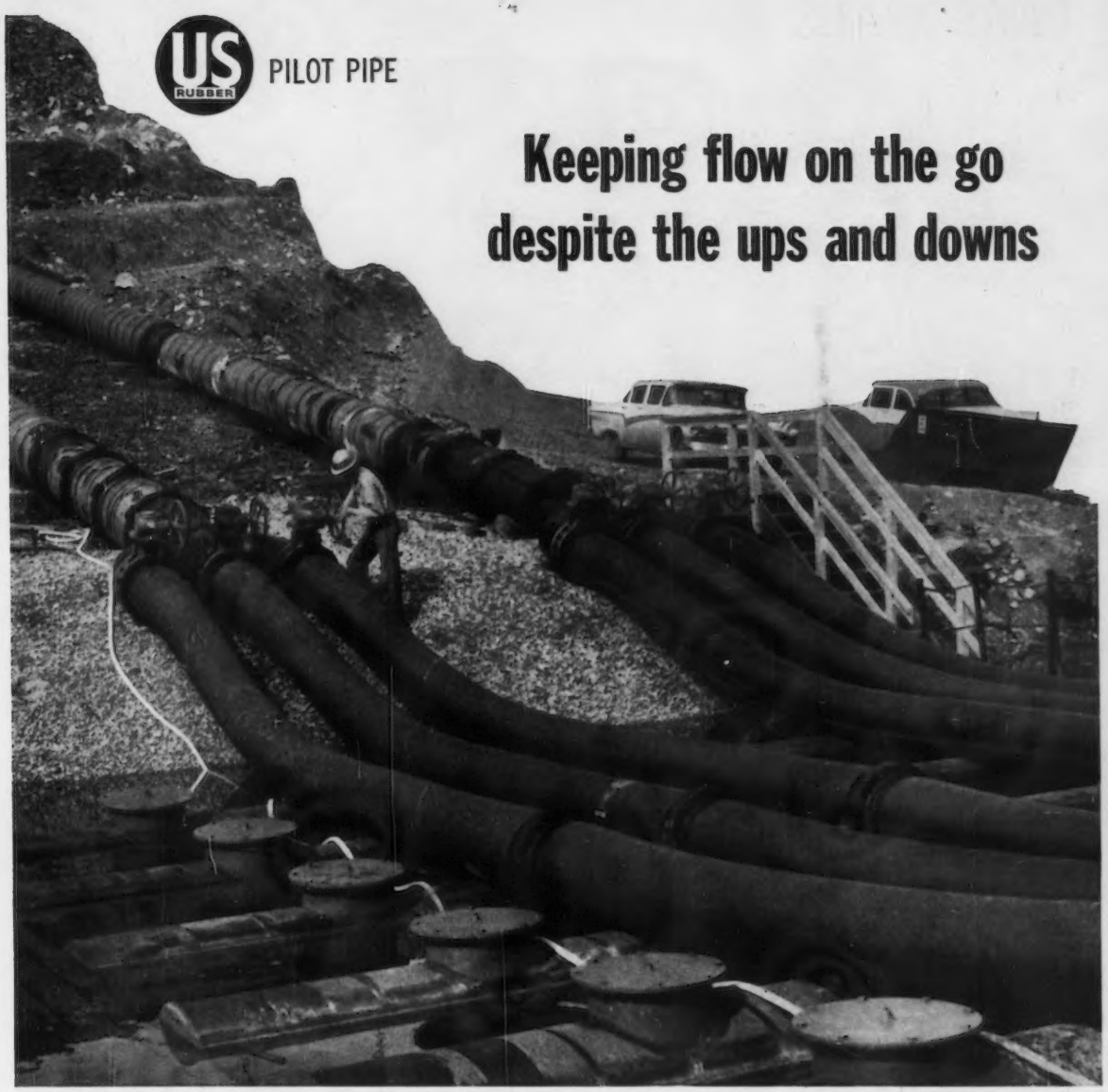

[1] R. J. P. Lyon and W. M. Tuddenham, MINING ENGINEERING, Vol. 11, December 1959, pp 1233-1237
[2] V. J. Schiedt, NATURFORSCH, Vol. 76, 1952, p 270
[3] M. M. Stimson, JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, Vol. 74, 1952, p 1805
[4] W. M. Tuddenham and R. J. P. Lyon, in process of publication
[5] V. Z. Williams, REV. SCI. INSTRUMENTS, Vol. 19, 1948, pp 135-178


## Table 1. Comparison of Chemical and Infrared Dust Samples for Quartz

| Sample | Percent −5 Microns | Contained Quartz, Percent Chemical | Infrared |
|---|---|---|---|
| A | 20 | 32 | 34 |
| B | 24 | 55 | 64 |
| C | 4 | 11 | 10 |
| D | 10 | 25 | 32 |
| E | 5 | 2 | 2 |
| F | 5 | 13 | 14 |

US RUBBER PILOT PIPE

# Keeping flow on the go despite the ups and downs



A taconite mining company in Minnesota operates 365 days a year, has capacity to produce 7,500,000 tons of iron ore pellets a year.

To produce a ton of taconite pellets requires over 100 kwh of electric power and 25 tons of water. This plant, at its present production rate, pumps almost 65,000 gallons of water a minute. It is utilized so carefully that the make-up water requirement is held to less than 5,000 gallons a minute.

*Two large diameter metal pipes lead from the barge pumping station to the concentrator. Three 16" U. S. Rubber Pilot® Pipe lines connect each pipe with the barge pumps. "U. S." Hose is used because due to rain or snow the barge may rise 7 feet or more, or sink as much as 10 feet, straining the hose and connectors.*

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# PERSONALS

**H. S. Harrison** was recently elected president of Cleveland-Cliffs Iron Co. **W. A. Sterling** was re-elected chairman and chief executive officer.

Mr. Harrison joined Cleveland-Cliffs in 1937. In 1940 he was made assistant treasurer and was subsequently promoted to the positions of treasurer, vice president and executive vice president.

He is also a director of Cleveland-Cliffs, Jones & Laughlin Steel Corp. and Medusa Portland Cement Co.

**John W. Chandler** is the new manager of the mining department of American Metal Climax Inc.'s Mining & Exploration Div.

He succeeds **C. A. R. Lambly,** who resigned to become president of the Trout Mining Co., formerly a division of American Machine & Metals Inc.

**Floyd B. Odlum** has retired as chairman of the board of Atlas Corp., the investment company he founded more than 30 years ago. Succeeding him as chief executive is **David A. Stretch,** who is president of the company.

In recent years, Odlum pioneered the development of uranium mining, assembling the largest independent uranium mining company in the United States.

Stretch entered the Atlas management in 1956 as executive vice president, becoming president in 1958.

**C. Jay Parkinson,** vice president and general counsel of the Anaconda Co. has been elected executive vice president and general counsel.

**Parkinson**

Parkinson joined Anaconda in 1941, and in 1955 was elected vice president of Anaconda Aluminum Co., a wholly-owned subsidiary. In 1957 he was named general counsel and a year later was elected vice president.

He is a director of the company and many of its subsidiaries.

**Dr. Philip J. Shenon,** former director of Day Mines Inc., has been elected president of the Society of Economic Geologists for 1960.

Dr. Shenon is now associated with the Salt Lake City consulting geological firm of Shenon & Face.

**Edward P. Rieder, Jr.,** is now industrial engineer of Reserve Mining Co.'s Silver Bay Div.

Rieder joined the taconite company in 1953 and was made an industrial engineer in 1956.

**Dr. Tell Ertl** has been appointed chief mining engineer for Cameron & Jones Inc., consulting engineering firm. His immediate assignment will be in Brazil as advisor to the Brazilian Government on oil shale mining.

Ertl headed the USBM research team at Rifle, Colo., in 1944-48; was consultant to the Union Oil Co. of California, 1948-58; and professor and head of the mining and petroleum engineering department at Ohio State University, 1950-55.

**REVIEWING PROBLEMS** and exchanging ideas are (l-r) committeemen Beals, Bury, Thompson, Halley, Winn, Stevens, Kinneberg, Pesout, Walje, Dow, Beck and Bennett.

## Kennecott 'Dozen' Meets for Idea Swapping

REVIEWING COMMON PROBLEMS and exchanging ideas of mutual interest are the goals of Kennecott Copper Corp.'s Smelting & Fire Refining Practices Committee.

The group, with representatives from each of the company's four Western producing properties, meets quarterly on a rotating basis at locations in Utah, Nevada, Arizona and New Mexico.

Members of the group are: **G. C. Beals** and **C. J. Bury** representing the WMD Engineering Dept.; **Raymond Thompson** and **Richard Walje,** Utah Copper Div.; **J. H. Halley** and **W. H. Winn,** Ray Mines Div.; **R. J. Stevens, W. C. Dow** and **W. A. Bennett,** Chino Mines Div.; **D. A. Kinneberg** and **Edward Pesout,** Nevada Mines Div.; and **R. R. Beck,** Research Center.

Mr. Stevens is committee chairman.

The Western Mining Div. has two additional activity committees, the Mining Practices Committee and the Milling Practices Committee, which also meet quarterly to discuss problems and exchange ideas.

**Andrew R. Sims** has retired as general superintendent of the Butte mines. His successor is **Edward O. Bonner** who was assistant general superintendent in charge of the Allice and Berkeley pits, Badger and High Ore mines and the Black Rock-Elm Orlu grade zinc project.

**Sims**

**Bonner**

In 1938, Sims was foreman of the Steward, foreman of the Tramway in 1941 and in 1946 was assigned as planning engineer for the Kelley Mine in the Greater Butte Project.

He was in charge of development work underground and also of sinking and concreting the Kelley shaft until he was promoted to assistant general superintendent of mines in 1950. He became general superintendent of mines in 1952.

Bonner was appointed foreman of the Tramway in 1941 and became assistant foreman of the Travona in 1945, foreman of the Orphan Girl in 1947 and foreman of the St. Lawrence fire fill in 1949.

He was named superintendent of the Belmont mine in 1951 and was appointed assistant general superintendent of mines in 1952.

**Robert W. Kliebenstein** has been appointed manager of Calument & Hecla's Marquez uranium mine on the San Mateo road north of Grants.

**Ray L. Schultze** has resigned as general manager of the New Mexico Div. of Hidden Splendor Mining Co. to join Rodney DeVilliers and Miss Stella Dysart in

# 14 CAT DW20 RIGS HELP SPEED PRODUCTION IN THE LUCKY Mc URANIUM MINE!

Located in isolated Gas Hills, Wyoming, the Lucky Mc Uranium Mine is classified as a medium-large open pit installation. Ore deposits occur from surface to depths of 500 feet. Overburden is composed mainly of loose sands and sandy shales. The stripping contractor, Utah Development & Mining Co., operates a fleet of 18 tractor-scrapers to haul this material. Mainstays of the fleet are 14 four-wheeled Cat DW20 rigs. Working 20 hours a day, 6 days a week, the fleet averages 30,000 yards a day on hauls of ¼ to ½ mile with maximum 6% grade. Two Cat No. 12 Motor Graders maintain the haul roads to keep the scrapers rolling.

Just as at Lucky Mc, the DW20 Series G Tractor and No. 456 Scraper is ready to deliver faster cycles and bigger loads on your job. Here's why: it packs 345 HP (max. output) and 12% higher rimpull compared to the former model. This increased rimpull provides up to 20% faster travel speeds under similar conditions. The new No. 456 Series B LOWBOWL Scraper has 8% greater capacity—19.5 cu. yd. struck; 27 cu. yd. heaped. There's also a new No. 482 Scraper, with a capacity of 24 cu. yd. struck; 34 cu. yd. heaped.

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Now optional for the DW20, the SynchroTouch Transmission Control is an advanced new way to shift gears faster and easier. The operator simply dials desired gear for automatic, split-second, touch-and-go response. Result: faster cycles and more payloads per hour.

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# PERSONALS *(Continued)*

their newly acquired See Tee Mining Corp. as vice president and operations manager and part owner.

**Ernest L. Ohle** has been named vice president-exploration of the Copper Range Co. Since 1957, Ohle has been chief geologist of Copper Range and its subsidiary, White Pine Copper Co.

Ohle

Forbes

**Jachin M. Forbes** has been named manager of minerals development for the Beryllium Corp., Reading, Pa.

Prior to his appointment, Forbes was an assistant vice president of Wm. H. Muller & Co. Inc. Previously he was employed by C. Tennant Sons & Co.

He also served five years with the U.S. Bureau of Mines.

**Morris V. Mielke** has been appointed assistant to the vice president-operations of U. S. Steel's Oliver Iron Mining Div. Mielke has been assistant general superintendent of Oliver's eastern district.

**John H. Hearding, Jr.,** general superintendent of the western district, has been named general manager of Oliver's operations on the Minnesota ranges.

**John Chisholm,** general superintendent of Oliver's eastern district, has been advanced to assistant general manager of Minnesota operations.

**N. G. Helland,** district superintendent in the Hibbing-Chisholm area, and **M. E. Johnson,** assistant general superintendent of the former western district, have been named managers in charge of mines and plants.

**E. A. Friedman,** former district superintendent at Coleraine, is now manager of maintenance for all of Oliver's Minnesota properties.

**Bruno Scipioni,** chief mining engineer in the eastern district, fills the new position of assistant to the manager of mining engineering.

**M. R. Sermon,** chief mining engineer for the western district, has been named superintendent of mining engineering for all Minnesota mines with **R. R. Wallace** as his assistant.

Other appointments include: **A. E. Matala,** superintendent of industrial relations for all properties; **E. A. Herman,** Matala's assistant; **R. W. Segar,** superintendent of industrial engineering; **J. B. Sundquist** and **J. R. Aho,** industrial engineering supervisors; **I. R. Lerohl,** superintendent of quality control and ore movement; and **M. H. Hall,** chief ore grader.

**H. S. Anderson,** manager of the New York and Honduras Rosario Mining Co. Mining Dept., has been named a vice president of the company.

Anderson

Wallach

**A. A. Wallach,** mineral industries development engineer, Kaiser Engineers, has been reassigned to the headquarters' office in Oakland, Calif.

Wallach's most recently completed assignment was as Kaiser's project manager responsible for the design and construction of an iron ore concentration pilot plant for the Wabush Iron Co., Labrador.

**Robert J. Kennedy,** manager of the W. S. Moore Co. Hibbing office, has been appointed assistant secretary of the company.

**Thomas Mesich** will succeed the late **John Johnson** as general pit foreman for the company.

**Robert J. Linney** was recently elected president and a director of Reserve Mining Co. Linney has been executive vice president of Reserve since 1958.

Linney

In 1937 Linney became general manager of Chateaugay Ore & Iron Co.'s mining and blast furnace operation. He became district manager of Republic Steel's Port Henry operations in 1945.

In 1950 he was selected manager of Reserve operations, and was named vice president-operations in 1956. He was elected executive vice president in 1958.

**E. R. Johnson** was elected to Reserve's board of directors to succeed **W. M. Kelley,** formerly president of Reserve Mining Co. Mr. Johnson is assistant president and first vice president of Republic Steel.

**B. F. Fairless** was recently elected president of the American Iron & Steel Institute.

Other new officers are: **Max D. Howell,** executive vice president; **William M. Akin, Arthur B. Homer** and **C. M. White,** vice presidents; **George S. Rose,** vice president and secretary; **Charles M. Parker,** vice president—research and

*(Continued on p 140)*

# OBITUARIES

**Murl H. Gidel,** 70, retired geologist, died March 18 at his home in Butte.

Mr. Gidel joined Anaconda Copper Mining Co. in 1912 upon graduation from the Montana School of Mines. He retired in 1958 at which time he was assistant chief geologist for North America.

He was a member of AIME and served as chairman of the Montana Section in 1931. He was also a member and past president of the Montana Society of Engineers, a member of the Montana Mining Assn., an honorary member of the Northwest Mining Assn., and a member of the American Mining Congress.

**Laurence Harper Norton,** 72, died June 11 at Gambier, Ohio.

Mr. Norton, formerly Ohio State Senator, was treasurer and director of the Oglebay Norton Co. and of several affiliated corporations. He was also president and director of the David Z. Norton Co.

**Ralph L. Healy,** 72, died in Brampton, Ontario, June 1.

Mr. Healy was general manager and a director of Wright-Hargreaves Mines Ltd. until his retirement in 1956. He formerly was with Granby Consolidated Mining, Smelting & Power Co.

**Earle C. Smith,** 68, chief metallurgist and director of research for the Republic Steel Corp., died May 20 of a heart attack.

Mr. Smith had been associated with United States Steel Corp., Central Steel Co. and United Alloy Steel Co. He was named chief metallurgist for Republic in 1932 and director of research in 1956.

During World War II Mr. Smith was on the Super Alloys Technical Industry Advisory Committee of the War Production Board and on the subcommittee on gun forgings of the Ferrous Metallurgy Board of Ordnance.

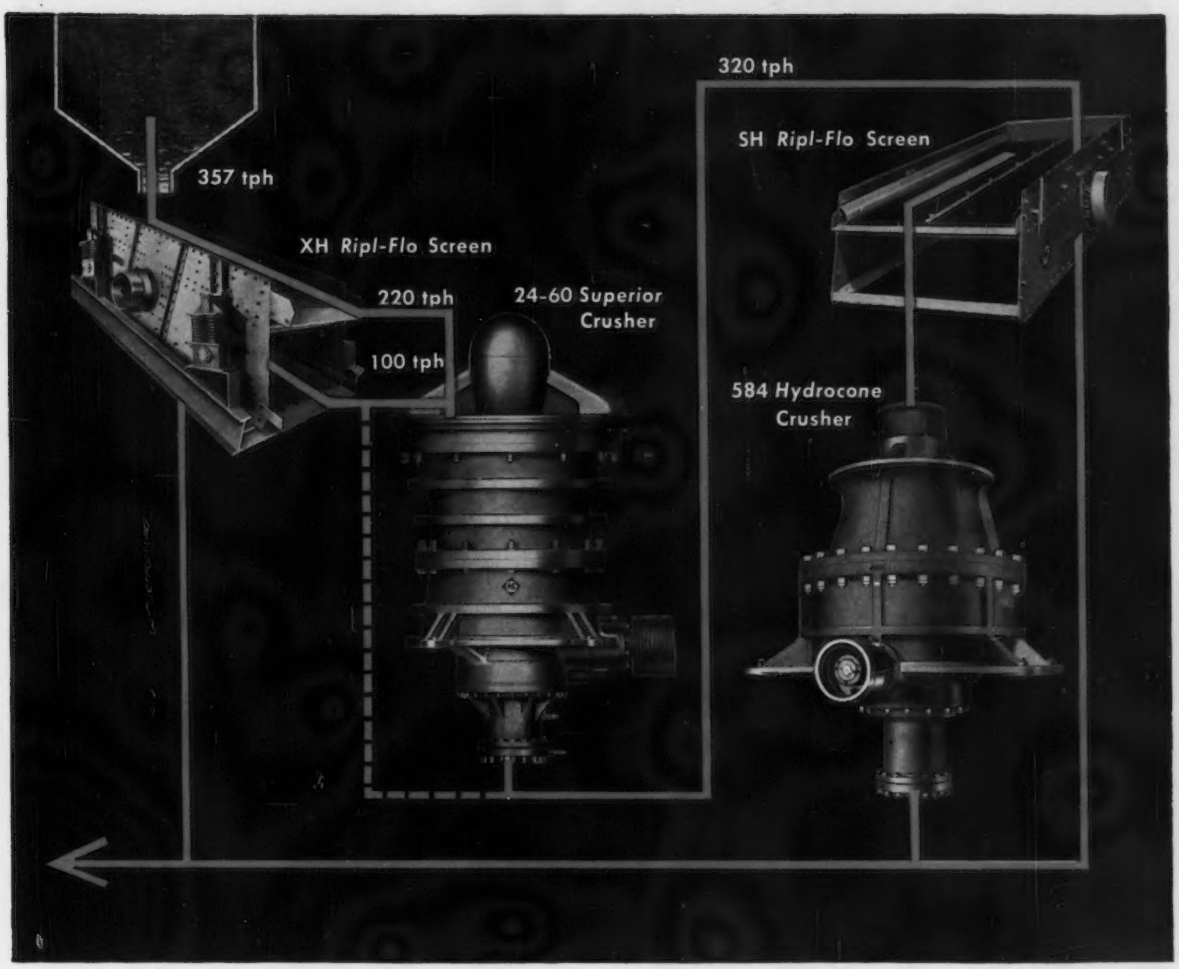
Mr. Smith was awarded the American Iron & Steel Institute Medal in 1940, and in 1946 received the Gold Medal of the American Society for Metals for outstanding service to the industry.

**Robert E. Kidd,** 59, Salt Lake City metallurgist, died recently in a Salt Lake City hospital of natural causes. Mr. Kidd had taught at the University of Utah and in Rapid City, S. D.

**Frederick William Nobs,** 78, for many years general manager of the Empire-Star Mines in Grass Valley, died May 21. Mr. Nobs was in charge of Newmont Corp. properties in the 1930s.

**Frank C. Harrison,** 48, safety officer for the Garrison mining operations of the Montana Phosphate Product Co., died June 15 in Deer Lodge, Mont., following an illness of several weeks.

# ALLIS-CHALMERS

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Secondly, A-C engineering service specializes in designing plant flows that bring out the best in equipment . . . designed for maximum efficiency, step by step, from bin to storage pile.

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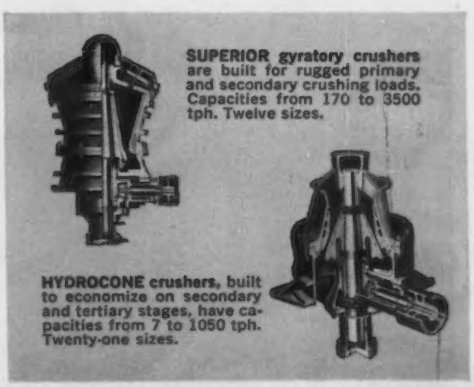
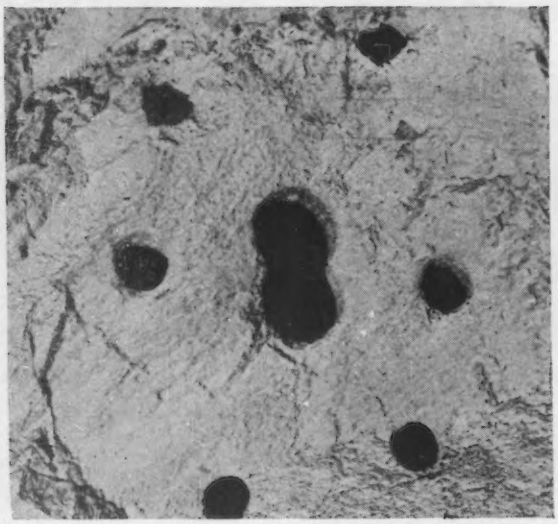

SUPERIOR gyratory crushers are built for rugged primary and secondary crushing loads. Capacities from 170 to 3500 tph. Twelve sizes.
HYDROCONE crushers, built to economize on secondary and tertiary stages, have capacities from 7 to 1050 tph. Twenty-one sizes.

# OPERATING IDEAS



## Coromant Cut Gives Long Drift Advance With Airleg Drills

THE COROMANT CUT is a simple, reliable and relatively inexpensive method for achieving long advances per round. In addition, it offers economies arising from faster drifting, and shorter setting-up time, according to Atlas Copco.

Essential feature of the cut is the drilling of a slot, formed by a number of small holes drilled closely together in the rock. A second feature is a template, with which unskilled workers can achieve a drilling precision which normally would only be expected from skilled and careful miners. The method permits miners working in small drifts (up to 10 x 12 ft) to use airleg equipment to drill large unloaded center holes for burn cuts. The center slot is made by drilling 2¼-in. holes close together with the aid of a guide tube. Although the drilling time is increased, longer rounds (over 8 ft.) are made possible. In fact, advances of up to 13 ft have been made at the Bodas mine of Sandviken Steel Works Co. Ltd., Sweden, where the method was tested.

Results of tests conducted by Sandvik disclosed that miners can achieve a long advance per round with uniform fragmentation in a small cross-sectional area. Also the entire round can be fired at once. With the aid of the drilling template, even unskilled miners can obtain satisfactory results.

The center hole is made by drilling the first hole upwards at least 5° to facilitate removal of drilling cuttings. A satisfactorily straight hole is ensured by keeping the rock drill steady with a suitable feeding pressure and by keeping the rod at the bottom of the hole mouth after some feet of drilling. After hole No. 1 is drilled and a guide tube inserted, possibly with the help of the air leg when hole No. 1 is too much deflected, hole No. 2 is drilled directly below it. After the center slot is drilled, the template comes into use for drilling the smaller (about 1¼ in.) holes.

The template comprises two plates mounted about 2 ft apart on two tubes welded together. After the slot has been drilled, these tubes are inserted into the hole. The holes in the template have exchangeable bushings. The first templates were made with six holes; but it soon proved advantageous—particularly for unskilled miners—to incorporate another four holes in the jig. These templates are comparatively simple and inexpensive and can easily be made to suit the desired drilling pattern. They greatly facilitate collaring and directing of the hole and after some practice unskilled miners can drill very accurately with the aid of the template.

The results achieved depend largely on the precision with which the holes are drilled and how the explosives are utilized. For this reason, it is advisable to begin with short advances.

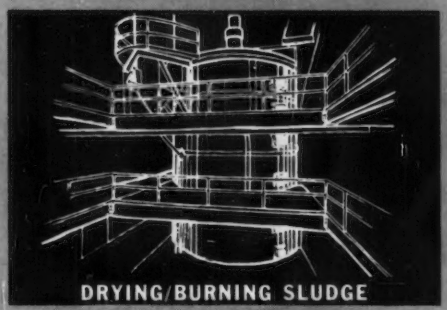
## Small Rail Crane Performs Multitude of Tasks in Pit

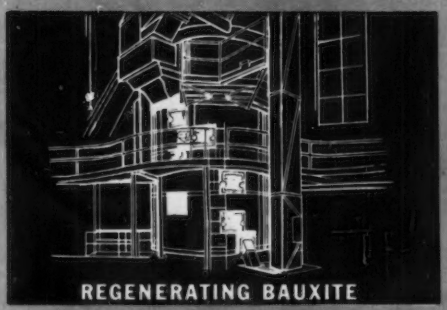
THE RAIL CRANE shown in the accompanying photograph has proved a versatile and efficient piece of equipment at the large open pit of Phelps Dodge Corp., New Cornelia Branch, Ajo, Ariz. It is used on pit levels inaccessible to trucks supplying shovels, drills, and other equipment, for rail and tie replacement work, and handling supplies and materials in general. The crane's principal part is an old Porter locomotive which was reworked at the company machine shop—building in a Hydrolift assembly, installing a 150-hp Diesel engine taken from an old truck, and building up the wheels of the locomotive chassis.

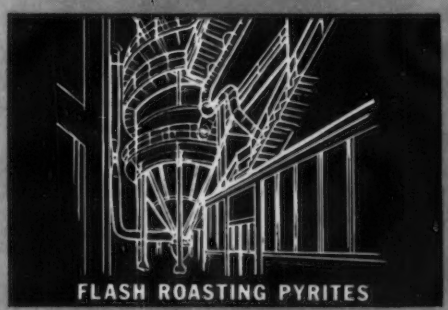
The Hydrolift unit is fitted with outrigger supports to provide extra stability during lifting operations. A wheeled auxiliary used in conjunction with the crane is a trailer designed to accommodate full length rails.

CALCINING KAOLIN

ROASTING NICKEL ORE


DRYING/BURNING SLUDGE


REGENERATING BAUXITE

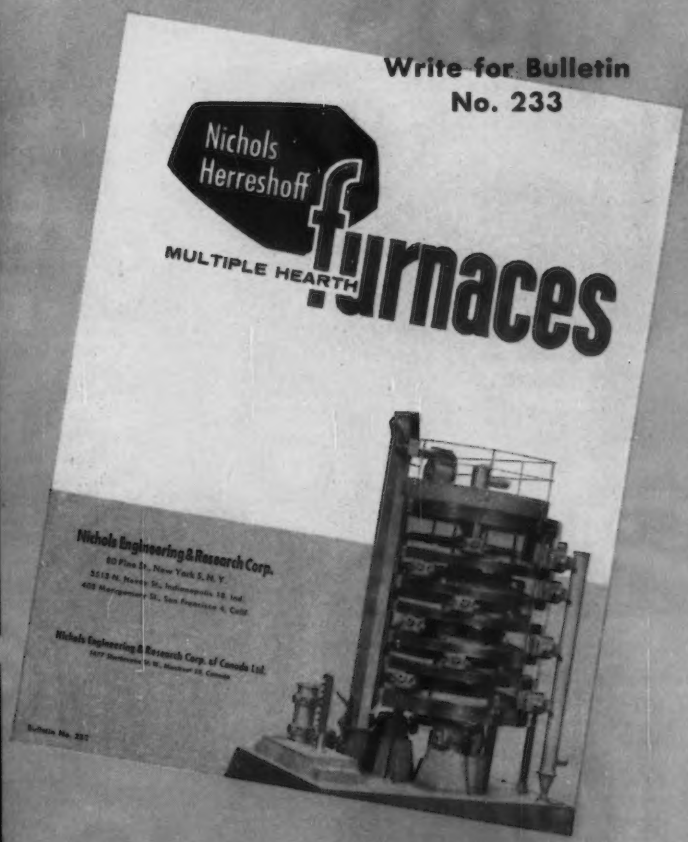

FLASH ROASTING PYRITES

# Treating-Processing furnaces

**Nichols Herreshoff* and Bethlehem Wedge multiple hearth furnaces and Nichols Freeman Flash Roasters are standard equipment throughout the world for calcining, drying, roasting or reducing ores, concentrates, sludges or slurries.**

**For a single unit or a complete thermal processing plant—consult Nichols. Laboratory services, custom roasting and pilot plant equipment are available.**

**Write for Bulletin No. 233**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MULTIPLE HEARTH furnaces
Nichols Engineering & Research Corp.
80 Pine St., New York 5, N. Y.
Nichols Engineering & Research Corp. of Canada Ltd.

**Nichols Engineering & Research Corp.**
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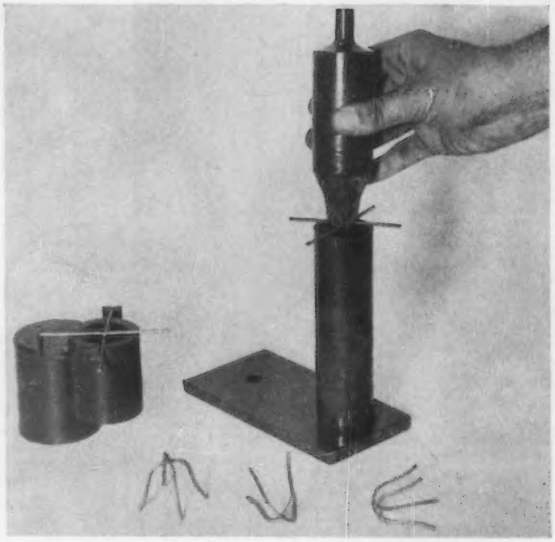
# OPERATING IDEAS *(Continued)*

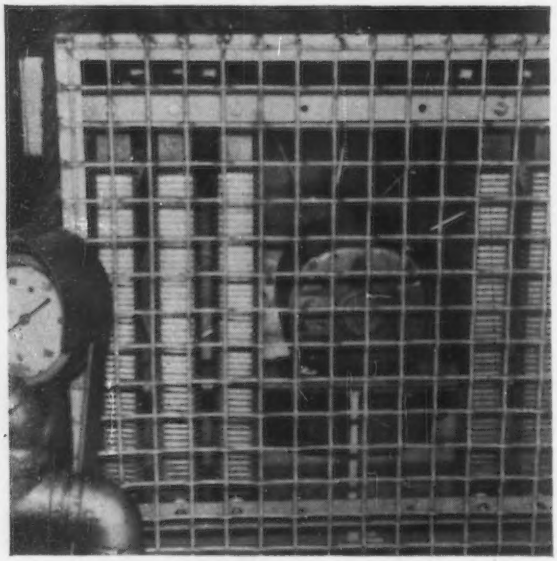
## Powder Retainer Keeps Dynamite In Holes with High Water Flows

ST. JOSEPH LEAD CO. HAS SOLVED THE PROBLEM of keeping dynamite cartridges in blast holes which are under water pressure, according to John J. Reed, head mine research engineer. Tamping the powder heavily, or using a solid tamping plug, will not solve the problem because high pressure will then develop which will blow out almost anything. Also each portion of the charge must be held against the bottom or against the previously placed charge in order to avoid a blank at the bottom of the hole or a gap in the explosive column.

A wire basket powder retainer holds the powder securely in the hole, forms no discontinuity in the explosive column, and does not restrict the flow of water out of the hole. Although there is little sparking hazard in holes containing water, salvaged No. 15 copper wire is used. The retainer is placed over the end of the tamping stick, and follows each dynamite cartridge, or group of cartridges, as it is pushed to the back of the hole.

For use in 1⅜-in. blast holes, the wires are cut 3½ in. long and brazed to form a cross. As shown in the photograph, the brazing is done in the jig at the left. After brazing, the retainers are stamped into their final shape in the die shown at the right. The dimension across the points of the finished retainers is 1⅞ in.





## De-Fogger Improves Jumbo Drilling

NEW DRILL JUMBOS in use by the St. Joseph Lead Co. have two out of three drills operated by remote control from the tractor seat. This puts the operator at least 20 ft from his machines and the face, and under the usual foggy conditions, he can neither see, hear, nor feel the individual drills. Because of the fog, he cannot see the face clearly to spot and collar a hole, nor can he see if the drill water is returning.

According to John J. Reed and Wayne M. Birch, a recent visit by management personnel to Kiruna, Sweden, has led to a solution to this problem. Under similar conditions, a 3kw heater-blower is used at Kiruna to dispel the fog at the jumbos. At St. Joe, the headings are somewhat larger, and a more powerful unit is required. Six finned strip heaters, wired in delta, for a total of 9.3 kw, are arranged behind a high-pitch 20-in. window fan directly connected to an 1800 rpm 3-phase ⅓ hp motor. All inside wiring is made from heater-type wire. In drilling faces 24-ft wide, deflectors are placed in front of the fan to direct some of the air out to the walls. Although very little heat is noticeable, it is enough to raise the temperature above the dew-point and eliminate the fog.

### Correction—Beryllium Detector

To the editor:

The operating idea, "Accurate, Easy-To-Use Detector Spots Beryllium Ore in the Field," (March, p104) may have given a misleading impression concerning the sponsorship of our work and our presentation. Our project was conducted for the Minerva Co., Eldorado, Ill., and they very graciously permitted us to describe the procedures developed under their sponsorship. We have not, at any time, been agents for the Nuclear Corp. However, we do appreciate their having made a Berylometer available to us in order that we could give a demonstration in conjunction with our talk.

Our paper was submitted to the Minerva Co. for their approval, and we are pleased to say that they released it with no restrictions. The Nuclear Corp. was given no opportunity to pass on the content of our paper. Their publicity agents did prepare preprints, with our authorization, but they did not change a word.

We hope E&MJ may be able to do something toward clarifying the matter. We presented the paper because our experience had shown that the gamma ray-neutron detector could be a powerful tool in locating much-needed beryllium deposits and felt that our experience should be shared with fellow explorers. The Nuclear Corp. has not claimed any connection with our work or our conclusions, and it is only fair that the record shows that our favorable views regarding the possibilities of the instrument were arrived at independently, on the basis of field performance.

**Louis and Pauline Moyd**
**Exploration Geologists**
**Yonkers, N.Y.**

# Thor

## Everything you want in Push Feed Drills . . .

## *and more!*

Thor's new model 330 push feed rock drill outperforms every other drill in its class . . . a fast, rugged, perfectly balanced drill with convenient controls. Two new feed legs have been engineered for use with the Thor model 330.

Model 333 is a power retracted feed leg, single stage, which extends 51" in operation. Feed rod extends from bottom of cylinder.

Model 335 is a telescopic, manually retracted leg which extends 73" in operation. Feed rod extends from the top of the cylinder.

Either leg is easily attached to the drill by a single nut.

Throttle valve controls the air and water supply to drill and feed leg. Ask your Thor "Red Tool" distributor or Thor service branch to demonstrate. Thor Power Tool Co., Aurora, Ill. Branches in all principal cities.

Thor POWER TOOLS

# San Juan de Lucanas

# reversed an orthodox flow scheme to cut cost-plus-tails on silver-lead ore!

Textbook metallurgy does not necessarily produce the lowest cost-plus-tails. San Juan de Lucanas experience demonstrates that.

High in the Andes some 400 miles S. E. of Lima on an Indian trail to ancient Inca workings, this mill treats 300 m.t.p.d. of a siliceous ore containing 4.72 gms. Au; 21.06 oz. Ag and 0.66% Pb per metric ton. Silver occurs mostly as argentite with some proustite and miargyrite. There are also small amounts of sphalerite and pyrite associated with galena.

At San Juan de Lucanas, cyanidation followed by base-metal flotation did not produce desired metallurgy. But tests at Cyanamid's Mining Chemicals Laboratories and on the mill revealed that reversing the flow scheme would be both practical and profitable.

Accordingly, mill feed is ground 55% minus 200 mesh in the presence of 0.19 lb/ton Sodium Cyanide and 0.22 lb/ton zinc sulphate. This reagent combination effectively depresses pyrite and sphalerite while amyl xanthate floats galena and associated silver. pH of the flotation circuit is 7.5. High precious and base metal recovery by flotation in the presence of quantities of cyanide is somewhat unique.

Flotation tails are cyanided with AERO® Brand Cyanide in nine agitators for approximately 52 hours. Recovery of precious metal values is excellent. Current reagent combinations and typical results are:

**REAGENTS, lb. per ton**

Flotation - 300 mtd.

| | |
|---|---|
| Sodium Cyanide | 0.19 |
| Zinc Sulfate | 0.22 |
| Amyl Xanthate | 0.12 |
| Frother | 0.025 |

Cyanidation - 294 mtd.

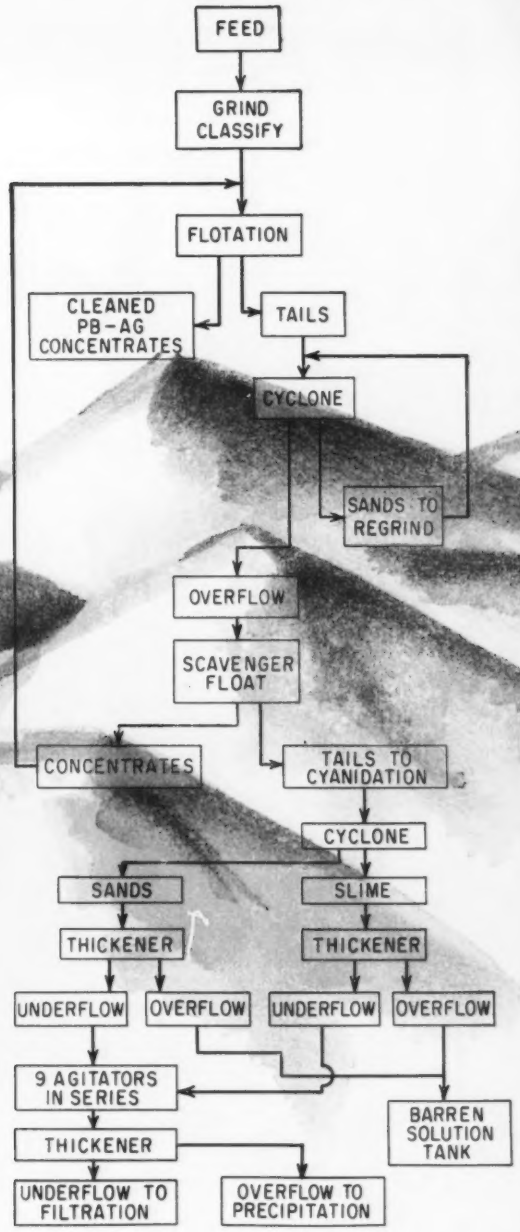
| | |
|---|---|
| AERO® Brand Cyanide | 12.0 |
| CaO | 7.0 |
| Zn dust | 0.2 |

Cyanide solution

Start 0.202% NaCN equivalent 0.058% CaO
Finish 0.179% NaCN equivalent 0.042% CaO

**TYPICAL RESULTS**

| Product | Au gm/ton | Ag oz/ton | Pb % | Recovery % Au | Ag | Pb |
|---|---|---|---|---|---|---|
| Flot. Feed | 4.72 | 21.06 | 0.66 | 100 | 100 | 100 |
| Flot. Conc. | 183.7 | 801.4 | 26.8 | 77.6 | 75.9 | 77.4 |
| Flot. Tails | 1.08 | 5.17 | 0.16 | 22.4 | 24.1 | 22.6 |
| Cyan. Tails | 0.01 | 2.02 | | 0.7 | 9.4 | |




Users and prospective users of Cyanamid Reagents benefit by the composite mineral-dressing knowledge acquired by Cyanamid's Mining Chemicals Laboratories from all world mining fields and on every type of ore over the past 40 years. They benefit by the unbiased creative test-work of this Laboratory in determining the right reagent combination for lowest cost-plus-tails and also by the practical in-the-mill help of Cyanamid Field Engineers. These extra values are an integral part of every shipment of Cyanamid Reagents . . . values which Cyanamid alone provides to customers and prospective customers.

**AMERICAN CYANAMID COMPANY**

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

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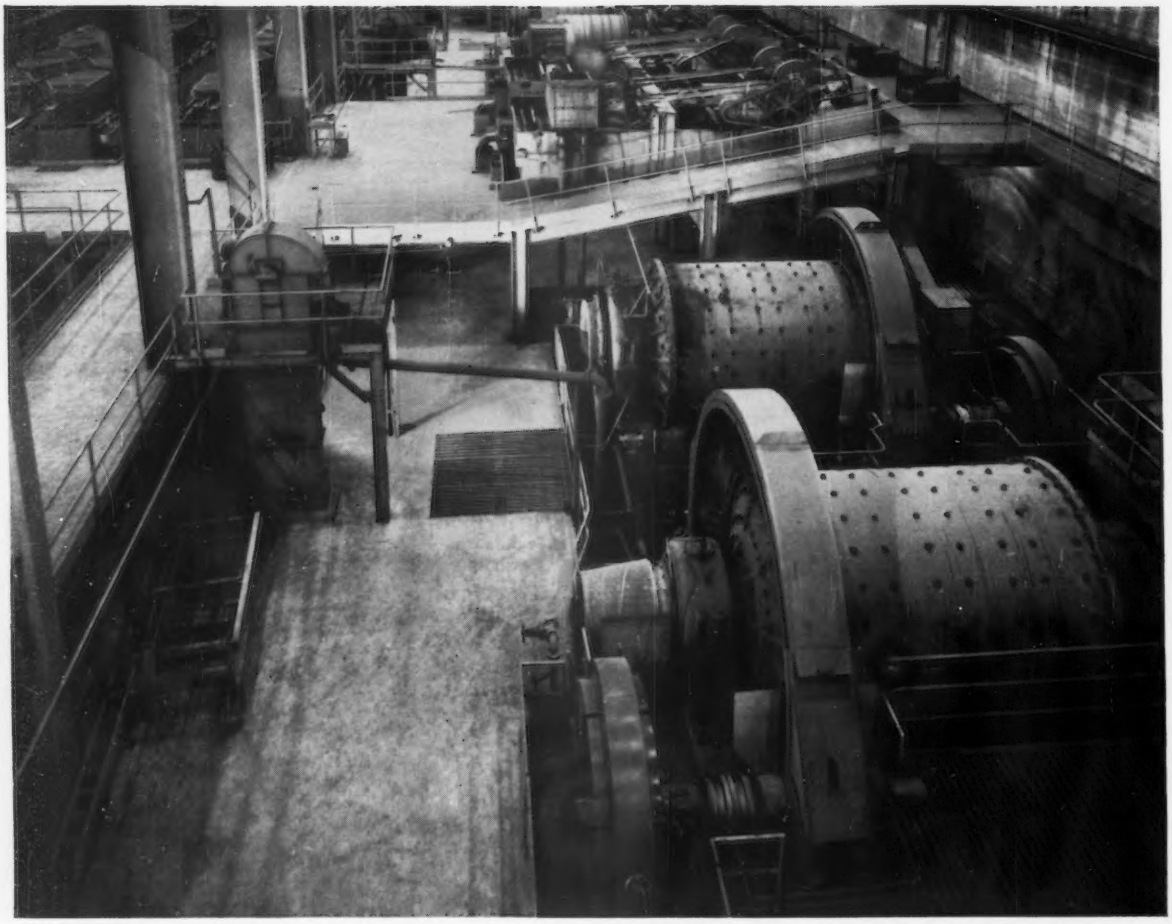

**Good for long grind.** Ni-Hard liners save labor, cut maintenance and grinding costs by providing the utmost in tonnage-life.

Results obtained in this grinding aisle at Inco-Canada show the type of economies you can count on for your own mills.

# Ni-Hard shell liners wear only .018 lb per ton grinding more than 3 million tons of nickel ore

This high tonnage-life demonstrates the outstanding performance of Ni-Hard* nickel-chromium white iron shell liners in the plant shown above.

In service since 1951, two sets of Ni-Hard lifter bar liners were removed recently from the rod mills here at Inco's Creighton concentrator in Canada.

### Used in large mill

The Ni-Hard shell liners served in 10′8″ x 13′ mills grinding highly abrasive nickel ores with 3″ and 3½″ rods. Mills ran at 60% of critical speed. At the discharge, solids in the slurry ran 70%. Total life in the #1 mill was 3,430,000 tons of ore; in #4 mill, 3,266,000 tons. The liners for each mill originally weighed 60,912 lbs.

This example of Ni-Hard shell liner service is a severe one . . . nickel ores are among the toughest. But the record of Ni-Hard liners in such service points up what this material can do in all grinding operations.

For answers to your further questions about Ni-Hard liners, just pick up the phone and call your nearby Ni-Hard producer. Or write Inco directly. We'll send you a list of authorized producers and a copy of the useful booklet, "Engineering Properties and Applications of Ni-Hard."

*Registered trademark

**THE INTERNATIONAL NICKEL COMPANY, INC.**

67 Wall Street — New York 5, N. Y.

# NI-HARD

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

# Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...

**Profitability?** Faced with the decision to expand your plant facilities, you should first determine whether all elements combine to form a pattern of future profitability. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers is an experienced designer and builder of all types of facilities for the Minerals industry. From Pre-Engineering through design and construction, Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

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**KAISER ENGINEERS** engineers - contractors
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6229-M

# WHAT'S NEW IN PATENTS

**OLIVER S. NORTH**

## U. S. PATENTS

### Exploration

**To detect uranium and thorium deposits deep underground,** a grid pattern of shallow boreholes (about 6 ft deep and 1 in. in dia) is drilled over the area to be examined; and the temperature of the earth is measured at the bottom of each borehole to locate any heat anomaly that might be due to nearby ore deposits. S. W. Milochik. No. 2,933,923.

### Mining

**Method for automatically maintaining the blowpipe tip of a thermal rock-piercing apparatus**—such as that described in U.S. Patent No. 2,679,381—at an optimum predetermined distance from the bottom of a blasthole being sunk in taconite, quartzite, granite, and similar hard rocks and ores. This distance is regulated depending on the spallability of the ore or rock being pierced. S. H. Royer, A. J. Miller and J. J. Calaman, assigned to Union Carbide Corp. No. 2,935,303.

### Metal and Mineral Processing

**Material is pelletized at a rate somewhat in excess of the amount needed directly for the sinter bed,** in an efficient method for agglomerating and sintering iron oxide ores, roasted pyrites, sphalerite flotation concentrates, and like fine materials; then the overage of green pellets is immediately returned to the feed supply of the pellet-making apparatus, so that no pellets are stored, especially during temporary stoppages of the sintering machine. K. Meyer, assigned to Metallgesellschaft AG. No. 2,934,421.

**Elimination of lime fluxing improves the chromium recovery without necessitating use of higher temperatures,** in a process for producing high-grade ferrochromium products from high- or low-grade high-iron chromium ore or concentrates. The charge that is smelted consists of ore, reducing agent and a flux comprising controlled proportions of silica, alumina and magnesia. M. J. Udy, assigned to Strategic-Udy Metallurgical & Chemical Processes Ltd. No. 2,934,422.

**In the recovery of vanadium values from carnotite leach solutions,** the solution is circulated through a large number of beds of an anion exchange resin. The temperature of the solution in the first column is maintained below 40° C to prevent precipitation of red cake, whereas the temperature in subsequent columns is controlled in the 50-70° C range. Vanadium is concentrated in the first, or cool, column, and is eluted therefrom with a strongly-acidic aqueous sulphurous acid solution. This acid leach liquor is agitated with anion exchange resin particles at 50-70° C, and then contacted with fixed anion exchange resin beds to precipitate insoluble polyvanadates. D. C. McLean and C. S. Abrams, assigned to American Cyanamid Co. No. 2,937,072-4.

**Improved fractional-distillation process to separate and recover high-purity columbium and tantalum pentachlorides** from chlorinated columbium ore concentrates in which the columbium-tantalum pentachloride weight ratio is at least 2 to 1, such as certain ores of British Columbia, Nigeria, South Africa and Norway. A. Mayer, assigned to Quebec Metallurgical Industries Ltd. No. 2,934,426.

**Economical hydrocarbon solvent-extraction process for recovering elemental sulphur** from native sulphur ores, Frasch "bin bottoms," sulphide residue from the concentration of metal-bearing ores, etc. P. R. Bradley, assigned to Alaska Juneau Gold Mining Co. No. 2,934,414.

**In a method for recovering a cation amine flotation reagent used in the froth flotation or agglomerate tabling of sylvinite ore,** the partially-dewatered amine-containing potassium chloride slurry is treated at moderate heat with a small amount of an aqueous solution of sodium or potassium hydroxide. The mineral particles are effectively freed of reagent, and the recovered reagent is readily reusable. W. P. Wilson and T. M. Cramer, assigned to U.S. Borax & Chemical Corp. No. 2,936,887.

## CANADIAN PATENTS

### Metal and Mineral Processing

**Rate of movement of pellets through the furnace is controlled by several gate members** in a new design for a shaft furnace for indurating iron oxide ore pellets and the like. Gate members can be adjusted to vary the rate of discharge and to break up any large clusters of pellets. At any horizontal plane, the material moves downwardly uniformly at a predetermined rate to accomplish optimum hardening of all pellets. I. H. Wynne, H. K. Martin and K. M. Haley, assigned to Oglebay Norton Co. April 19, 1960. Canadian 596,672.

**To prevent loss of permeability in sinter beds,** e.g. beds of iron oxide ore or pyrites residue, the bentonite-bonded pellets are dried, and sprinkled with a small amount of hydratable lime or magnesia; then the material is charged to the sinter grate while the lime or magnesia is still in hydratable condition. Moisture condensed during the sintering process is taken up by reaction with the lime or magnesia, so that the agglomerate structure of the bed is maintained stable. W. Davies, assigned to United Steel Companies Ltd. April 12, 1960. Canadian 596,071.

**For use in roasting of iron oxide, molybdenite, and like ores, a device is provided for rapidly raising the temperature of the finely divided ore while limiting fuel consumption to a minimum.** The ore is subjected to high-temperature preheating; then is roasted. Residual heat from the pre-heater is utilized in the roasting furnace. W. A. Patterson, assigned to Fort Pitt Bridge Works. April 19, 1960. Canadian 596,634.

**Dross is withdrawn by an inclined elevator so arranged that liquid lead can drain back into the condenser** in a shock-chilling condenser for condensing zinc as liquid from zinc vapor, in which liquid lead is used as the circulating medium. The dross so obtained is high in zinc and low in lead. L. J. Derham, assigned to Metallurgical Development Co. April 19, 1960. Canadian 596,578.

**In a low-stack blast furnace and related process for producing metallurgical-grade alumina from siliceous bauxite,** a mixture of bauxite, pyrites and gas coke is charged into the furnace, blasted with cold air enriched to an oxygen content of 50-70%, and passed through a zone heated to 1750-1850° C. The resulting alumina-containing slag is recovered and hydrolyzed. P. Tardieu and R. Périères, assigned to Pechiney, Compagnie de Produits Chimiques et Electrométallurgiques. April 19, 1960. Canadian 596,598.

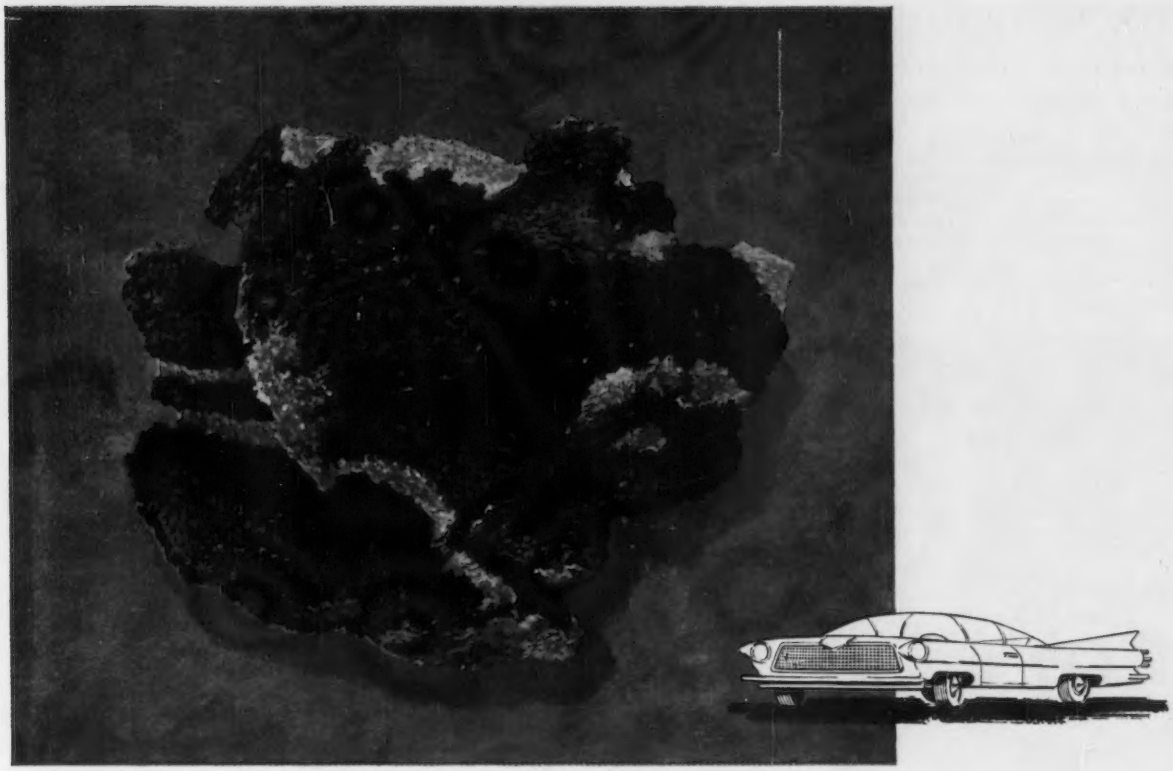
**Sticking or caking of the reduced powder product to the kiln walls is largely prevented** in a rotary kiln for use in the reduction of nickel oxide and roasted nickel mattes to produce nickel metal powder, by lining the kiln with a metal or alloy that will form a continuous unreduced-oxide film at the temperature of the operation. Suitable metals are aluminum, chromium, manganese and titanium. D. H. West, S. C. Townshend and A. B. Simpson, assigned to International Nickel Co. of Canada Ltd. March 29, 1960. Canadian 595,231.

**In the recovery of manganese from high-iron manganese ores or high-manganese iron ores,** a charge consisting of ore, coal or coke, a flux, and sodium chloride or an alkaline-earth-metal chloride is smelted at a high enough temperature to produce molten iron, a low-melting slag and chlorine gases containing the manganese values. The gases are cooled with steam, to hydrolyze the manganese as the oxide, and the solid manganese oxide is separated from the residual ferric chloride vapor. R. A. Halversen, assigned to divers individuals. April 19, 1960. Canadian 596,657.

**COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.**

**Copies of Canadian Patents can be obtained by writing to the Patent Office, Ottawa, Canada.**

Mr. North is patent consultant, Washington, D.C.



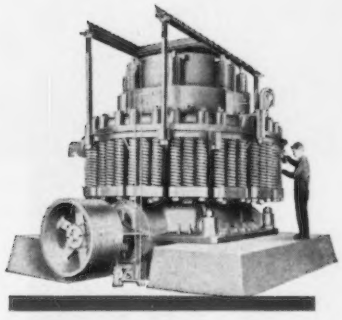
# SPHALERITE

## the "deceitful" ore of useful and ornamental ZINC

Zinc, from the ore *sphalerite*, is a metal of great economic importance. In the automotive industry alone, the increasing decorative and functional use of zinc die castings for grilles, instrument cluster housings, dash panel bases, door handles, etc., demonstrate the ore's economic value. It has long been used for galvanizing, brass making, and zinc-white pigments.

From earliest times, sphalerite has been known as the "treacherous" or "deceiving" ore. There is no other mineral whose appearance varies so much and which is so difficult to recognize on sight. It resembles galena but yields no lead. It is often host of many rare elements such as gallium or cadmium as well as many common minerals. Black sphalerite may contain as much as 18% iron.

This "deceitful" mineral and other zinc ores are efficiently and economically reduced by Symons Cone Crushers to the fine, uniform size necessary for further processing. As in all important ore and mineral operations throughout the world, Symons Cone Crushers are first choice of leading producers for high capacity production at low cost.



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***. . . The machines that revolutionized crushing practice . . .*** **are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.**

**NORDBERG MFG. CO., Milwaukee 1, Wisconsin**

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## First Iron Ore Comes Up From Pea Ridge Mine

HIGH GRADE magnetite ore from the combined Bethlehem Steel Co. and St. Joseph Lead Co. venture near Sullivan, Mo., is seeing the light of day as the $40-million Pea Ridge project moves toward production (E&MJ, April 1958, p 179).

First ore was struck June 4 at the 1680 level.

**E. L. BILHEIMER,** resident manager of the Pea Ridge, picks up one of the first chunks of 63% Fe magnetite. The white line shows demarcation from porphry into the orebody.

Previous surface core drillings have revealed the presence of a 100-million-ton iron orebody, according to James D. Idol, director of the Missouri Resources & Development Commission; and the first shaft explorations may prove up even more tonnages. Probes reaching 3,000 ft were still in the ore justifying the sinking of the shaft to that depth. At the 1680-ft level, now reached, more core drillings will be carried out. E. L. Bilheimer, resident manager, says: "We feel reasonably certain of having 100-million tons now, but we want to conduct further explorations underground to see if the orebody is even larger."

A second shaft, for the main recovery of the ore, has been sunk to the 1131-ft level. It too, will go down to 3,000 ft. Encased in reinforced concrete, the shafts are 22 ft in dia.

The Missouri Pacific Railroad is building a $3-million spur line from Cadet, to the mining operation. The spur will be 25 miles long. Bethlehem will construct a pelletizing plant at the site to receive the ore.

## Canadian Supreme Court Dumps B.C. Reserves Tax

THE CONTROVERSIAL British Columbia Mineral Property Taxation Act was ruled invalid by the Supreme Court of Canada in June.

The Court, by unanimous decision, ruled that the provincial Legislature had exceeded its powers in 1957 by passing the act which levied a tax on reserves in the ground.

The Supreme Court decision was made at conclusion of an appeal by Texada Mines Ltd. of Vancouver against a B.C. Appeal Court decision declaring the legislation valid.

The B. C. Appeal Court had reversed a judgment by Mr. Justice H. J. Sullivan of the B. C. Supreme Court, holding the legislation invalid because it imposed an indirect tax, a field reserved for Parliament.

The act gave the Cabinet power to designate mineral-producing areas, and to determine minerals to be taxed at a maximum rate of 10% of their assessed value.

## Minerals Engineering Buys Howe Sound Plant

PURCHASE of the old Howe Sound Co. cobalt refinery 20 miles west of Salt Lake City has been announced by R. G. Sullivan, president of Minerals Engineering Co. The plant will be converted to produce vanadium pentoxide "for atomic energy uses, alloy steel and vehicle smog control devices," Sullivan said.

Previous plans for a new refining facility adjacent to Minerals Engineering's Salt Lake tungsten plant have been set aside, the company said.

"Purchase of the Howe Sound plant will enable us to begin production of commercial grade of vanadium pentoxide definitely by the beginning of the fourth quarter," Sullivan said.

In May, Minerals Engineering signed a five-year contract for the full by-product vanadium production of the Minerals Products Div. of Food Machinery & Chemical Corp. of New York City. The vanadium concentrate to be received by Minerals Engineering, beginning early this month, will be the first known commercial program in the U. S. to extract vanadium from the hundreds of millions of tons of phosphatic ores in the Phosphoria formations of Utah, Idaho, Wyoming and Montana.

## Reserve Mining To Use Natural Gas In Pelletizing

CONTRACT NEGOTIATIONS paving the way for the construction of a natural gas pipeline between Duluth and Silver Bay have been completed between Northern Natural Gas Co., Iron Range Natural Gas Co. and Reserve Mining Co.

The contracts specifically cover the proposed sale of natural gas by Northern and Iron Ranges to Reserve for its taconite processing plant at Silver Bay. This will mark the first use of natural gas in iron ore processing in this area.

W. A. Strauss, executive vice president of Northern Gas, said that his company would immediately file the necessary application for FPC approval to build the new line to Silver Bay. He explained that the application will not only seek approval for the sale to Reserve but also will embody plans to provide natural gas service for Silver Bay and Two Harbors.

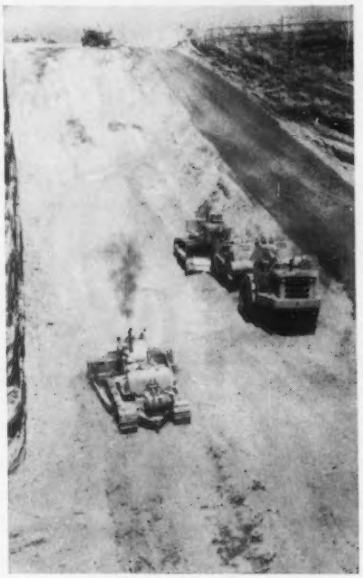
Under the terms of the 10-yr contract, Northern will supply Reserve with up to 12-million cu ft of "firm" gas per day for use in Reserve's existing pelletizing facilities and also make available another 14-million cu ft of gas for the taconite company's power plant requirements.

## First Offshore Sulphur Mine Starts Operation

COMMERCIAL OPERATION HAS BEGUN at the world's first offshore sulphur mine—a large steel structure erected in the ocean. Located seven miles off the coast of Louisiana in the Gulf of Mexico, the one-half-mile-long structure is the principal part of a $30-million Freeport Sulphur Co. project to mine a major new sulphur deposit known as Grand Isle. Mining is by the Frasch process. (See E&MJ, March 1959)

## New Crusher for Mission

WORK IS PROGRESSING RAPIDLY on construction of a crusher at the Mission (copper) Mill of American Smelting & Refining Co., Tucson, Ariz. Approximately 5,000 yd of concrete and 400 tons of re-bar will be used to support the crusher system of the 15,000 tpd beneficiation plant due for completion in the fall of 1961, according to W. R. Mahoney, chief construction engineer of AS&R and G. C. Kitchin, construction manager for Western-Knapp Engineering.



**EXCAVATION** for crusher foundation nears completion at AS&R's new plant.

# Learning is a two-way street

Working with drill operators to achieve top performance from Gardner-Denver rock drills is all in a day's work for the Gardner-Denver Mining Specialist. It's also his job to record suggestions from mine operators and drill runners for product changes that will improve performance.

This exchange of knowledge benefits both company and customer—resulting in drilling equipment that is designed for the work to be done. No customer buys *just* a drill from Gardner-Denver. With his purchase, he benefits from all the extra services that make the difference between an acceptable and an outstanding customer-supplier relationship. That's why it's good business to call your Gardner-Denver Mining Specialist.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

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# MAGNETOMETER
## MAKES 9-MILE SURVEY IN ONE AFTERNOON

Speed is typical of Varian's M-49 portable ground magnetometer. Unlike earlier magnetometers, this revolutionary proton-free-precession instrument measures total field intensity. Hence it requires no leveling, critical orientation or calibration and reads directly in gammas with consistent and accurate repeatability. Freedom from leveling lessens operator fatigue and also provides versatility of use.

This particular survey, done near Mount Diablo State Park in California, included 120 stations. The distance was covered by motor vehicle, but all readings were taken far enough away from the vehicle to eliminate possible error. The survey clearly indicated faults and subsurface geologic features.

The Varian M-49 weighs only 16 pounds. Two miles of traverse per hour can be covered by a man on foot taking readings as often as every twenty paces.

For full information, write the
Varian Instrument Division

VARIAN associates
PALO ALTO 29, CALIFORNIA


## Surface Mining Meeting To Be Held in Arizona

THE COLLEGE OF MINES, University of Arizona, is sponsoring a symposium on surface mining practices scheduled for Oct. 17 and 18, following the Mining Congress meeting in Las Vegas. The symposium will be held at the University in Tucson, Ariz.

To date, promises have been made by seven prominent operators in the U.S. to present papers. Several more are expected in the near future.

## Battelle Announces New Columbium Metal Process

Scientists at Battelle Memorial Institute have developed a process that may lead to continuous production of columbium, and replace the batch processes now used. This is important because, according to a recently-released Battelle report, a columbium-uranium alloy may be well suited for making fuel elements for compact and gas-cooled nuclear reactors.

The fluidized-bed vapor-deposition process works like some of the fluidizing reactors used in the mineral industry and elsewhere. Hydrogen gas is blown through a bed of seed columbium particles, at 1500° F. When volatile columbium pentachloride is fed into the chamber, the hydrogen reduces it to metallic columbium, which deposits on the seed particles. Grinding some of the finished product and feeding it back into the bed to replenish the seed.

Dr. Joseph H. Oxley, of Battelle, announced the new process on June 20 at the First International Congress of Chemical Engineering in Mexico City. Battelle developed the process for Nova Beaucage Mines Ltd.

The new reduction system was developed on a laboratory scale, but it may provide the basis for a commercial method. It can produce columbium with less than 500 ppm of impurities, pure enough to meet the specifications of nuclear reactor fuel elements.

## Wyoming Miners Elect Coulson to Presidency

ROY COULSON, manager of Vitro Mining Co.'s operations in the Riverton area, was elected president of the Wyoming Mining Assn. to succeed Myron L. Sisson of Colorado Fuel & Iron Co., Sunrise.

C. J. Paustian, Greybull, was elected vice president and H. E. Potter, Laramie, was named secretary-treasurer. R. W. Beamer, Riverton, was reappointed executive secretary.

In a resolution adopted at its fifth annual convention last month, the association urged measures to control inflation and keep low-cost foreign goods from continuing to cut into the nation's export markets.

In other resolutions the association urged:

1. A long-range national mineral policy by the Federal Government.
2. Accelerated minerals research by the U.S. Geological Survey.
3. Private development of Wyoming coal deposits for low-cost steam electric plants rather than "uneconomic taxfree plants which compete unfairly for industrial and urban electric power customers and thus delay the normal development of the electric utility industry."
4. More flexibility by the AEC in fulfilling uranium ore allocations where an allocation system is in effect.
5. Return to the state of 90% of the royalties from public lands.
6. No consideration of the proposed Wilderness bill until the National Outdoor Recreation Resources Review Commission makes its report.
7. A halt to "the continued trend toward federalization of the west."
8. Elimination by law "of the devices employed by labor leaders and management to destroy competition in our free enterprise system. . . ."

## Cerro Takes Control of Rio Blanco Copper Corp.

THE HOLDINGS of Cerro de Pasco Corp. in Rio Blanco Copper Corp. were increased to 88.3% last month in a shares exchange. Cerro has held option and performed exploration on the estimated 120-million ton copper orebody owned by Rio Blanco about 31 miles northeast of Santiago, Chile.

An average grade of 1.58% Cu has been indicated in the porphyry deposit, and block caving has been discussed as the mining method (E&MJ, July 1959, p 134).

Robert P. Koenig, president of Cerro de Pasco, observed that, if negotiations with the Chilean government are successful, the firm expected to mine year-'round at the property despite the heavy winter snowfall at the 11,000-ft altitude.

## Seven Copper Producers Join Development Group

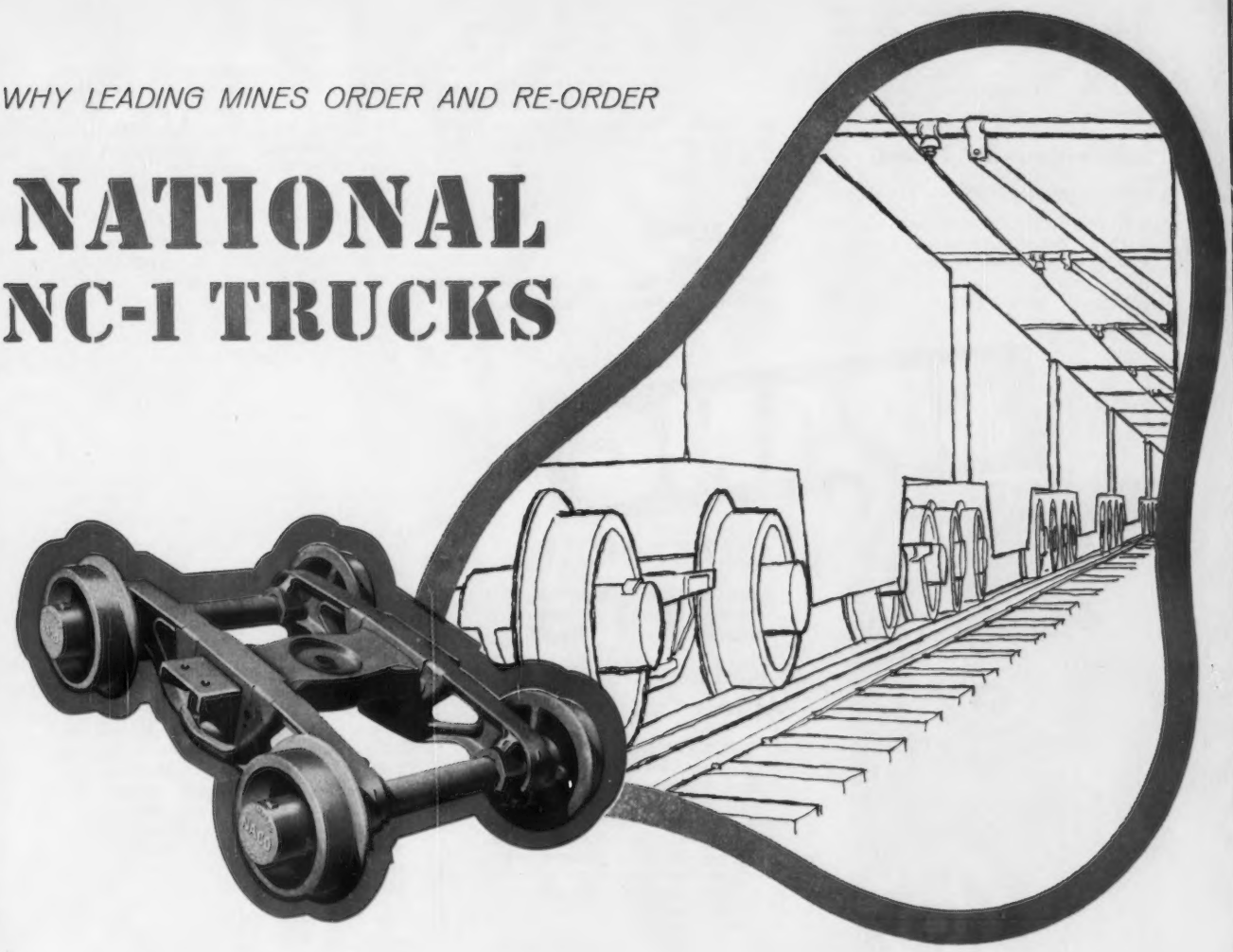
SEVEN MORE PRODUCERS of copper have been elected to membership in the Copper Products Development Assn., according to an announcement by Charles R. Cox and Clyde E. Weed, chairman and president, respectively, of the recently organized research association.

The new affiliates bring the total membership of the CPDA to 18. The CPDA's purpose is to find and promote uses for copper and it is now in the process of planning a long-range research and development program. The Association is negotiating with various laboratories in this country and abroad for conduct of its work.

The new members are Compania Minera Disputada de las Condes S.A., Duval Sulphur & Potash Co., Hudson Bay Mining & Smelting Co. Ltd., Mount Isa Mines Ltd., Pima Mining Co., Southern Peru Copper Corp. and the Tennessee Corp. The other members include American Metals Climax Inc., American Smelting & Refining Co., Anaconda Co.,

*WHY LEADING MINES ORDER AND RE-ORDER*

# NATIONAL NC-1 TRUCKS



The reasons for the decided swing to National NC-1 Trucks are fundamentally two: they provide safety to personnel and equipment... they make money for mine operators. There are lots of technical reasons, too. Let our representatives tell you all about them.

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***Cleveland 6, Ohio***

## CPDA *(Continued)*

Calumet & Hecla Inc., International Nickel Co., Inspiration Consolidated Copper Co., Kennecott Copper Corp., Miami Copper Co., O'okiep Copper Co. Ltd., Phelps Dodge Corp., and Tsumeb Corp. Ltd.

## Johns-Manville Takes Lease on Asbestos Deposit

A MINING LEASE FOR ASBESTOS has been taken by Johns-Manville on a quarter-section of land on northern slope of Mount Diablo, Calif. Land may contain deposits of up to 48 tons of asbestos, which J-M plans to refine at its Pittsburg, Calif., plant.

Asbestos was discovered by geologist Ray Johnson, affiliated with the newly-founded Bisso & Lord Mining Co., Concord, Calif. Johnson believes the asbestos is in an inverted cone structure, which will get richer as the land is worked downward. Bisso & Lord also has rights to chromite, hematite, and copper ores near Mt. Diablo.

## ARIZONA

**The White Mountain Apache tribal council has opened a 120,200 acre section of** the Fort Apache Reservation to prospecting for iron and other minerals. Sealed bids will be received until July 7 for exclusive rights for a two-year period to prospect for all minerals except oil and gas. The area lies in the northwest corner of the reservation in Gila and Navajo Counties. Mining leases are to run for 10 years from date of Interior Department approval. Government surveys show iron content of deposits in the opened area range from 6 to 63.97%.

**Bagdad Copper Corp. is instituting a $2-million leaching-in-place program,** including construction of a plant for sulphuric acid production from elemental sulphur.

David C. Lincoln, president, announced and noted that the acid will be applied to Bagdad's oxide ore stockpile, with the leach liquor run through cementation tanks and the cement copper to the smelter.

Lincoln estimated output at 20 tpd from the stockpiled ore and indicated that the oxide ore stockpile will be expanded with daily stripping from the orebody. Construction is expected to take about one year.

## CALIFORNIA

**Mountain Copper Co. Ltd. has completed a new pyrite cinder processing plant** at the company's chemical works in Martinez. Cost of the addition was in excess of $300,000. Basic operation at Martinez is the manufacture of copper compounds. New facility permits the recovery of copper and zinc through the beneficiation of iron oxide ores. Company officials hope to recover other metals, such as iron, gold and silver, as well as copper and zinc, with the new facility.

**The Jack Waite Mining Co.,** which for nearly 50 years has operated the Jack Waite and other properties in Idaho, has announced through Philip A. Borelli, president, the acquisition of leases on 100 patented and unpatented mining claims in San Bernardino County, Calif. Borelli said the company would proceed with exploration work immediately.

## IDAHO

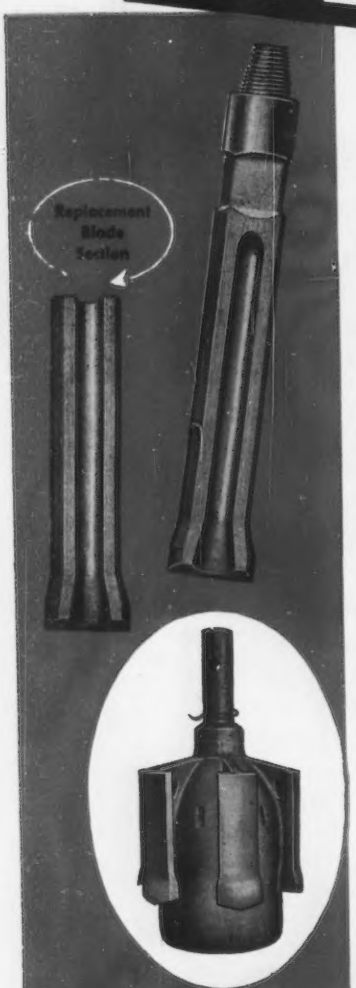
**A memorial scholarship honoring the late John D. Bradley,** president of the Bunker Hill Co., has been established at the University of Idaho. Funds for the scholarship to assist worthy students entering the College of Mines will come from gifts to the John D. Bradley memorial scholarship fund from members of the mining industry and friends. Bradley and his wife were killed last Thanksgiving Day in an automobile crash near San Francisco.

**Clinton A. Gunderson, Clair Meeks and Dale Larsen are incorporators** of a new Idaho corporation, Monida Thorite Inc., which owns 62 claims in the Lemhi pass section of Lemhi County near Salmon.


SPANG

BLAST HOLE BITS

*Drill More Holes Per Bit, At Less Cost Per Hole*




SPANG CHURN DRILL BITS, famous for long life and economy in the drilling of blast holes for the fragmentation of minerals or overburden, drill *more-holes-per-bit* at *less-cost-per-hole,* because they are fully heat-treated from end to end and have the *extra strength in pin and blade sections* to stand up under the toughest drilling conditions. They are made with semi-dressed ends for quicker, easier finish-dressing, in High Carbon, A.I.S.I. 4340, and Spang Molloy Steel.

Available also, as an added economy, are SPANG REPLACEMENT BLADE SECTIONS in the same grades of steel, and uniform forge section, for welding to pin and collar sections of original bits when long service has worn the integral blade to a point where replacement is desirable.

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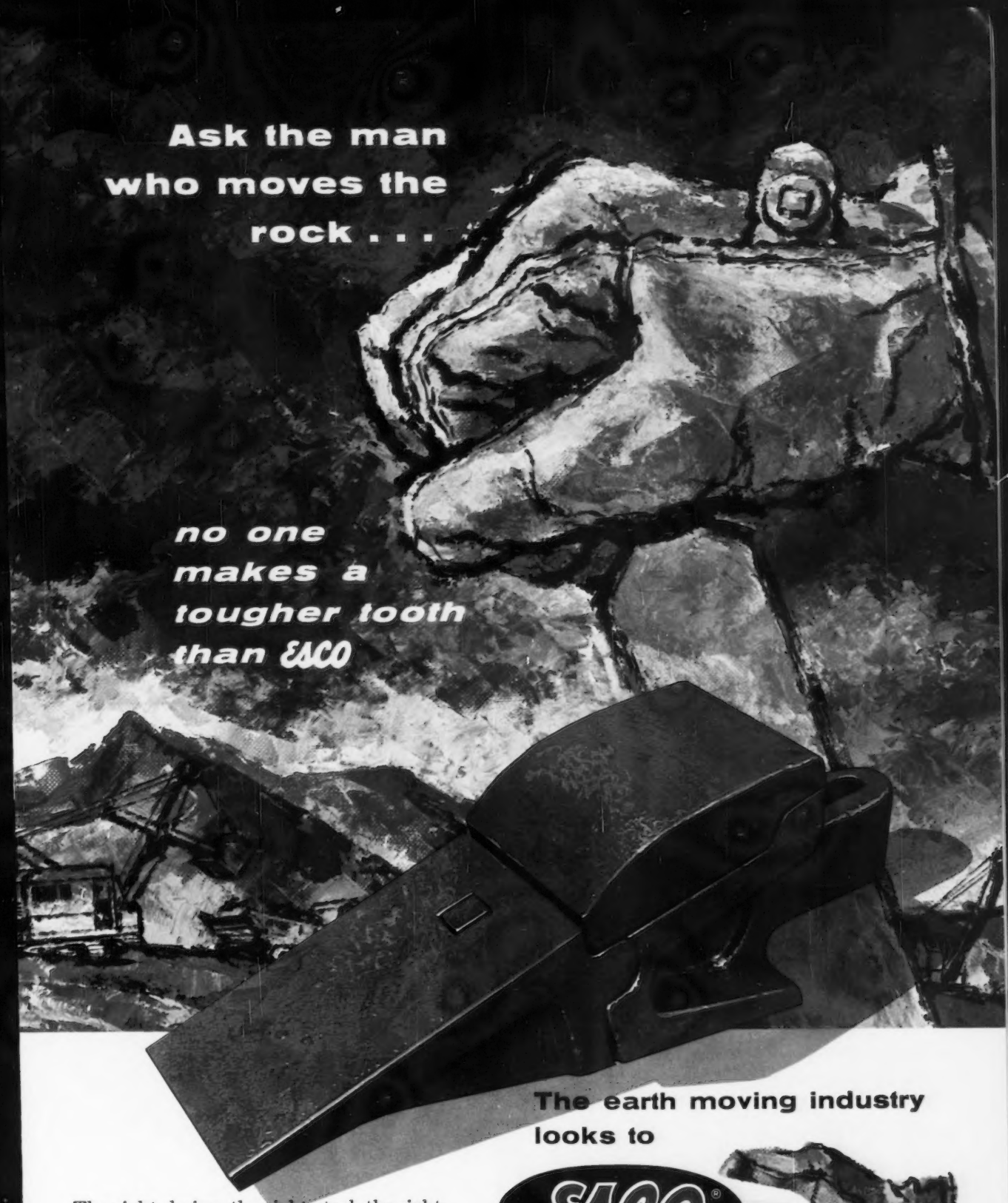


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Each easy-to-change ESCO Point is Brinell tested to assure exactly the right degree of shock-absorbing toughness and abrasion-resisting hardness for longer life. Abrasion resistant Wear Caps (illustrated) extend adapter life.

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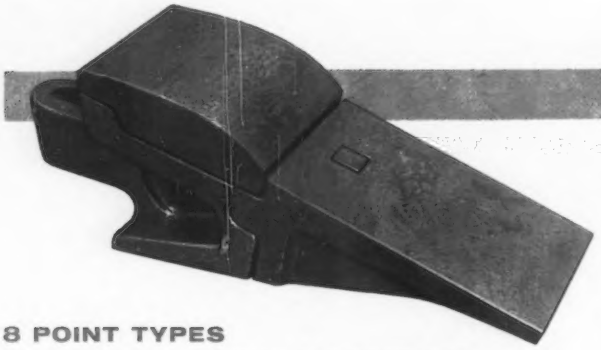
*ESCO* 12M Two Piece Teeth are the toughest you can use. Developed through years of research for the earth moving industry, cast *ESCO* 12M is the finest steel made for severe shock and abrasion.

## ESCO TWO PIECE TEETH

### for all your digging equipment

Your *ESCO* dealer can supply two piece teeth for all your equipment. Consult him about standardizing on *ESCO* teeth for the added advantages of quantity purchasing and reduction of on-the-job inventories.



## WEAR CAP ADAPTERS

The ESCO Wear Cap Adapter, winner of the Blue Ribbon Mining Award, is the most rugged tooth assembly ever developed for handling tough rock and taconite. Replaceable wear caps sharply increase service life by protecting the adapter from wear. No special pins or welding required.

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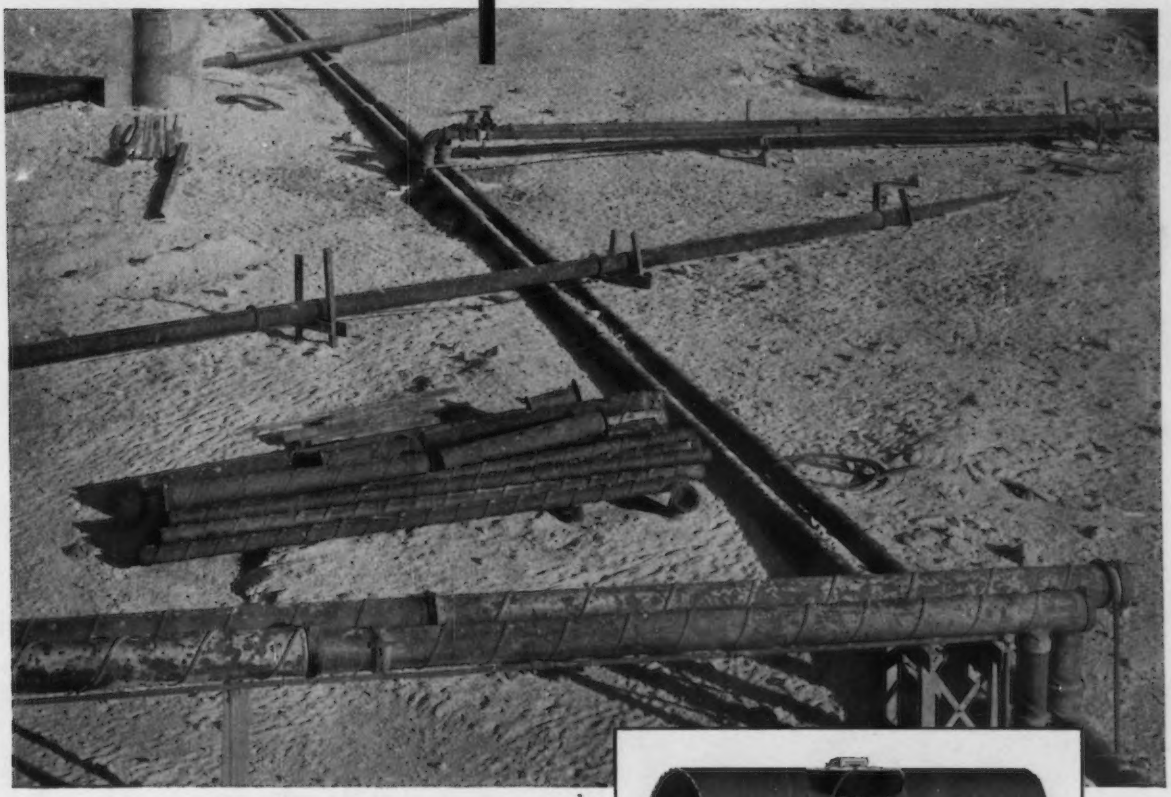
## Use This NAYLOR Pipe and Coupling Combination



When it comes to pipe lines in mining and quarrying service, you'll like the combination of NAYLOR Spiralweld pipe and Wedgelock couplings.

Easier handling comes naturally with this lightweight pipe. The NAYLOR lock-seamed-spiralwelded structure adds the strength and safety your job requires.

With the Wedgelock coupling, you save time in making connections, and simplify the work involved since a hammer is the only tool required to connect or disconnect it.

The NAYLOR Wedgelock coupling makes a positive connection, securely anchored in standard weight grooved ends.

For air, water, tailings or ventilating lines, it will pay you to consider this hard-working combination. Just ask for Bulletin No. 59.

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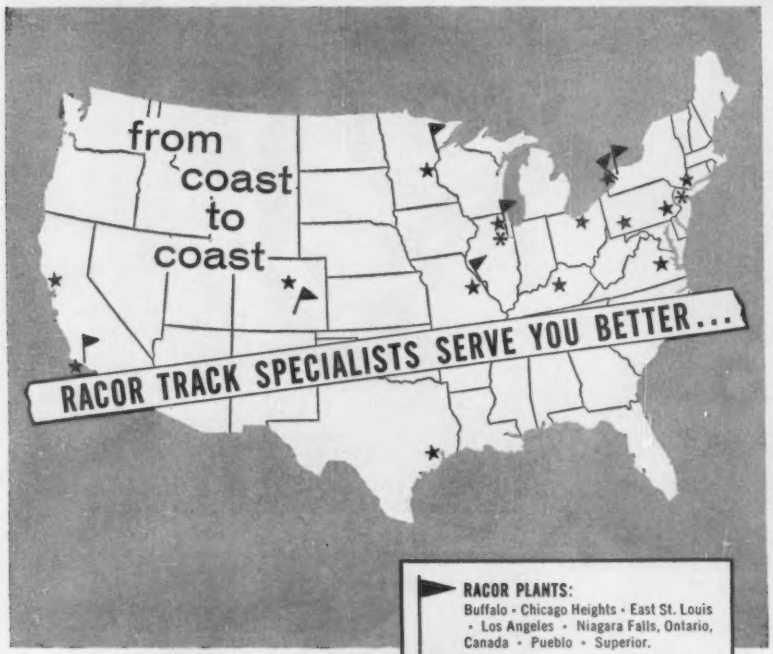
## Idaho *(Continued)*

The company's first meeting was held in Salmon and plans were outlined for an extensive development program at the company's holdings during the summer and fall months.

**"Exploration at depth is the aim of the Vindicator Silver-Lead Mining Co.** for the coming year," W. J. Logus, president, told stockholders at their annual meeting in Wallace. "Success of the Lucky Friday Silver-Lead Mines Corp. in the same area where the Vindicator is located has prompted the decision to begin a new exploration program at the Vindicator."

**Work on the new phosphoric acid plant of the Bunker Hill Co.** at Kellogg is continuing without interruption despite the strike that idled the company's operations. Completion of the project on time or even slightly ahead of schedule is expected.

**D. B. Lewis, president of Nuclear Fuels & Rare Metals Corp.,** has announced the company's acquisition of the $11-million holdings of Salmon Uranium Co. and Idaho Thorium Co. and other properties in the Lemhi pass area of Idaho and Montana. Nuclear Fuels now holds more than 7,000 acres of choice properties in those areas.

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## COLORADO

**Rehabilitation work has been started on the Humboldt Mine** on Ute Creek near Idaho Springs, and production is scheduled to resume after 25 years idleness.

Richard Mackey is in charge of the operation that includes timbering and clean-up work in one of the three tunnels of the property. Mackey is operating under a purchase option with J. E. Tinsley, vice president of Mary-Foster Humboldt Inc., owner of the property. A mill has been placed in operation at the nearby Crazy Girl Mine and will process ore to be trucked from the Humboldt.

## MINNESOTA

**The annual report of St. Louis County mine inspector, Ben Kangas,** for 1959 shows 1,034,171 tons of iron ore shipped from four underground mines; and 15,021,182 tons from open pits. Stripping moved was 14,217,504 cu yd and total men employed was 9,256. There were four fatal accidents during the year: one in underground mines, one in mine plants and two in open pits. Largest shipper for the year was Oliver Iron Mining Div.'s Rouchleau pit at Virginia, 4,123,771 tons. Second was Erie Mining Co.'s Hoyt Lakes taconite plant, operated by Pickands Mather & Co., 4,088,156 tons of pellets; while Reserve Mining Co.'s Silver Bay taconite plant was third with 3,603,602 tons. Twenty companies participated in the mining and concentrating in 1959.

**The Albany Mine at Hibbing, Pickands Mather & Co.,** which has been experimenting with new mechanization equipment in underground mining methods, is well satisfied with results to date and find they have attained the improvement that was estimated.

**The Corsica mine at McKinley,** closed in July 1954, and now leased by Lake

# When there's roof to be bolted... Bethlehem contact men help you test and install

Experienced Bethlehem contact men are ready—anytime—to help you with the original installation and testing of Bethlehem mine roof bolts and accessories.

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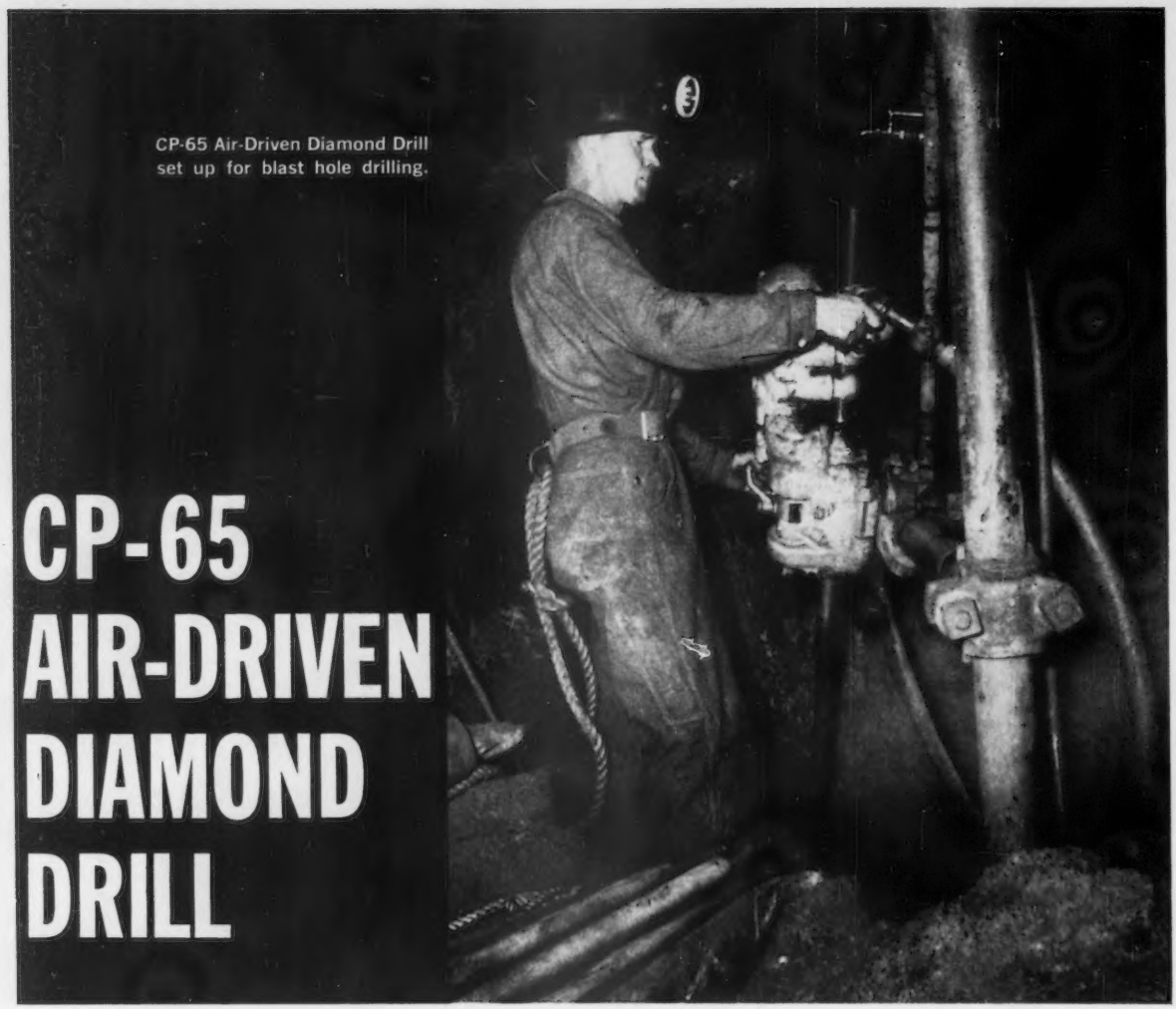

CP-65 Air-Driven Diamond Drill set up for blast hole drilling.

# CP-65 AIR-DRIVEN DIAMOND DRILL

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# FOR BLAST HOLES AND CORING

Easy as a drifter to handle, the CP-65 Air-Driven Diamond Drill packs the power for fast footage in all formations.

The CP-65 features an all-new vane-type motor with 50% more power than its record breaking predecessor delivered . . . this extra power is producing faster drilling rates and greater capacity under all drilling conditions.

Reversibility speeds rod handling. Makes up or unscrews rod joints quickly . . . gets back to the face, fast!

Rated at 600 foot capacity with EW Fittings. Keeps bit costs low . . . core recovery high because air motor permits delicate bit control.

Soundly engineered, balanced in design, the CP-65 with built-in swivel head is a compact 42½" unit, weighing only 200 pounds.

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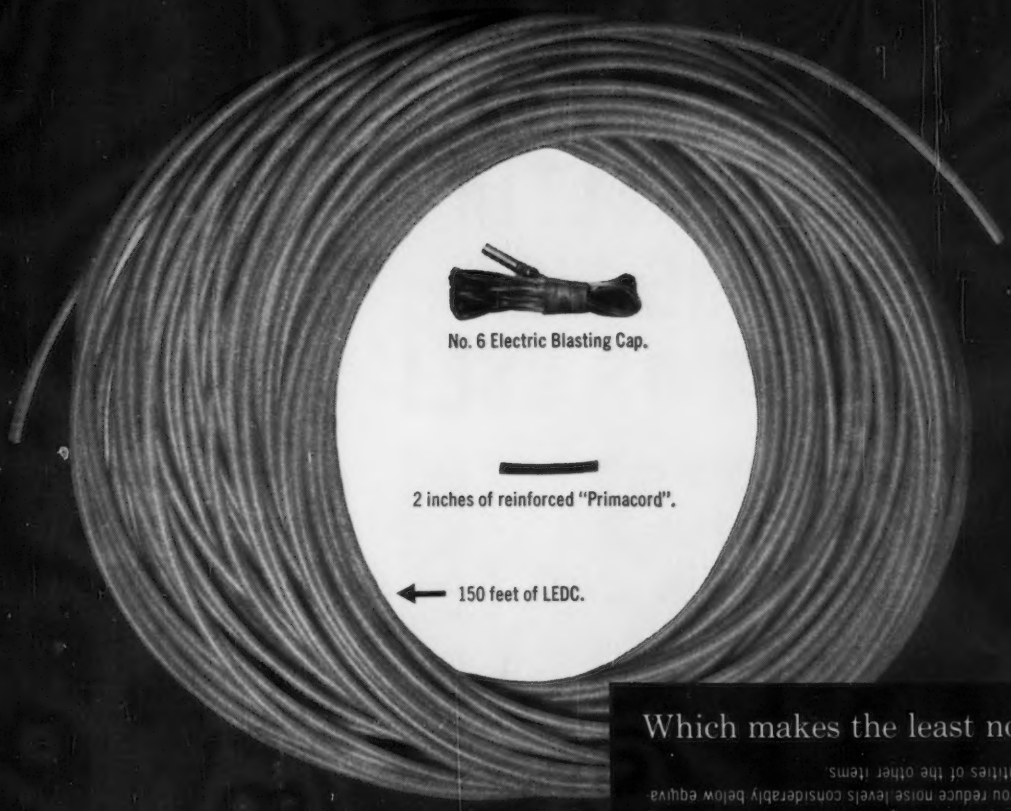


Which makes the least noise?

Answer: All three items produce the same amount of noise. Thus when you use the low noise level trunk line blasting system, you reduce noise levels considerably below equivalent quantities of the other items.

# Shhhh!

## New Du Pont delay blasting system* hushes the noise of quarry, open pit and strip mine blasting

If you have been burying your "Primacord" trunk lines, or have reluctantly switched to electric blasting caps in order to reduce the noise level of your blasting, here's good news.

**Reduces noise** The new Du Pont Low Noise Level Trunk Line Delay Blasting System* uses LEDC (Low Energy Detonating Cord) developed by the Ensign-Bickford Company in a cooperative program with Du Pont. It muffles the noise without the nuisance and expense of burying the cord. 150 feet of LEDC makes no more noise than one electric blasting cap!—or 2 inches of ordinary "Primacord"!

**2 grains per foot** This low noise level trunk line system contains only 2 grains of explosives per foot, as contrasted to 50 grains per foot in the regular "Primacord." It is this tiny load that keeps the noise level down. Our customers report noise and vibration complaints from neighboring residents were actually eliminated, when LEDC trunk lines were recently introduced.

**Other features** This system uses trunk line delay connectors, available in intervals of 10, 15 and 25 milliseconds. You can select the interval best suited to your particular blasting problem. The low noise level trunk line delay blasting system provides an unlimited number of periods at intervals of 10, 15 or 25 milliseconds. And at no time is it ever necessary to place a blasting cap in the borehole.

**Available now** Your Du Pont distributor or representative can help you reduce your noise problem with new LEDC at once, or answer your questions about it. Call him. Or write Du Pont, Explosives Department, 6440 Nemours Bldg., Wilmington 98, Del.

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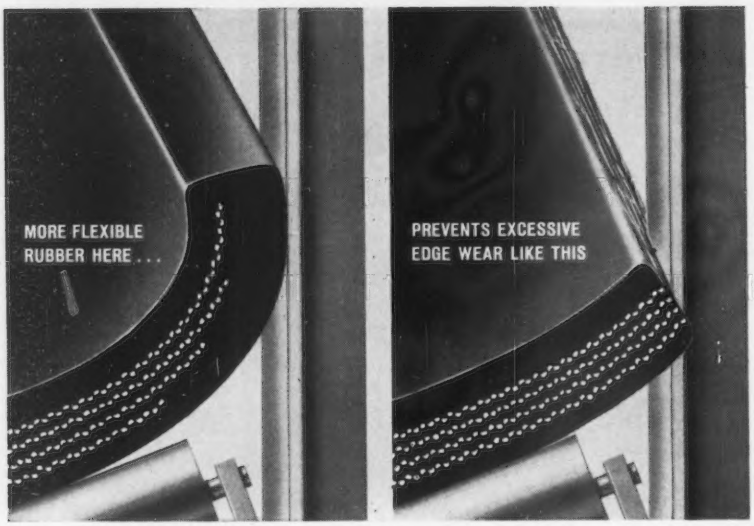


Improper training can ruin a conveyor belt faster than any other abuse. Riding up and rubbing against a frame member soon wears away the stiff edge of conventional belting and exposes the carcass plys to moisture, mildew, dirt and eventual ply separation. "Coledge" belt construction was developed by Thermoid Division —to overcome this weakness and extend belt life.

"Coledge" construction puts plenty of extra rubber on the edges where it counts . . . plys are stepped back to make a more flexible edge that rides with the punches when misalignment occurs. This "Coledge" construction is available in any standard type belt.

So, if you have an edge-wear problem with conveyor belts, specify "Coledge" construction. See your Thermoid Division distributor for technical data or assistance or write, *Thermoid Division, H. K. Porter Company, Inc., 200 Whitehead Road, Trenton 6, New Jersey.*

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## Minnesota *(Continued)*

Mining Co., is being reopened by Pickands Mather & Co. It contains an estimated 1,740,888 tons. Pumping was stopped at the mine in January 1955, and the pit filled with water to a depth of 264 ft. Dewatering began at the rate of 5400 gpm to be increased gradually to 7500 gpm. The mine is expected to be cleared of water by late summer or early fall. Engineers estimate that a total of one and a half billion gallons of water must be pumped. The Corsica will be opened in conjunction with the Embarrass pit, also a Lake Mining Co. property, and operated by Pickands Mather & Co. While the mine is being dewatered, mine buildings and equipment are being repaired and installed.

## MICHIGAN

**Pickands Mather & Co.'s Michigan mines went on a four-day-per-week schedule** beginning the first week of May. This includes the Buck Mine at Caspian, Menominee range, which reopened in April 1959 after having been closed for about one year; the Sunday Lake at Wakefield, the Geneva and Newport at Ironwood, and the Cary at Hurley, Wis., all on the Gogebic range.

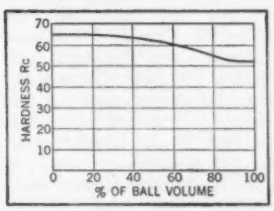
**On May 15 Hanna Mining Co.'s Wauseca Mine employees** and their families attended a meeting at which they were presented national honors for an outstanding accomplishment in safety. The Wauseca had the best safety record of the 58 underground metal mines which competed in the national safety contest for 1959. Fifteen mines had records free from disabling accidents but the Wauseca had worked more man-hours than any of the others. It was the first time the Wauseca had won the Sentinels of Safety trophy. Their record of 332,563 man-hours with no lost time accident was the highest for any competing underground metal mine. The green and white Sentinels of Safety flag will fly at the mine for one year. Each employee of the mine will receive an individual citation for his part in the group achievement.

## MONTANA

**On May 28, the American Chrome Co. of Nye, Mont.,** a subsidiary of the Goldfield Consolidated Mines Co. reported that its underground operations had completed one full year without a lost-time injury. In this period, a total of 213,000 tons of chromite ore was produced from four operating levels in the mine resulting in 110,309 tons of chromite concentrate, the major portion of which was sold to the government.

At the present rate of production, it is expected to complete the contract by the end of 1961. In the interim period, the company erected an integrated ferrochrome industry based on domestic ore; the only one in the United States, to obtain data to determine if the opera-

**Immediate delivery on USS Grinding Balls** We can ship immediately from stock as requested a range of sizes from ¾″ to 4″ in USS Carbon-Manganese and USS Alloy Steels. Here are three reasons why USS Grinding Balls should be specified: **Maximum hardness** combined with superior toughness. **Deeper hardness penetration** achieved by careful combination of chemical composition and heat treatment. **Uniform roundness** from ball to ball, load to load, for less wear and superior performance. If you have a delivery, performance, or selection problem, call our nearest Sales Office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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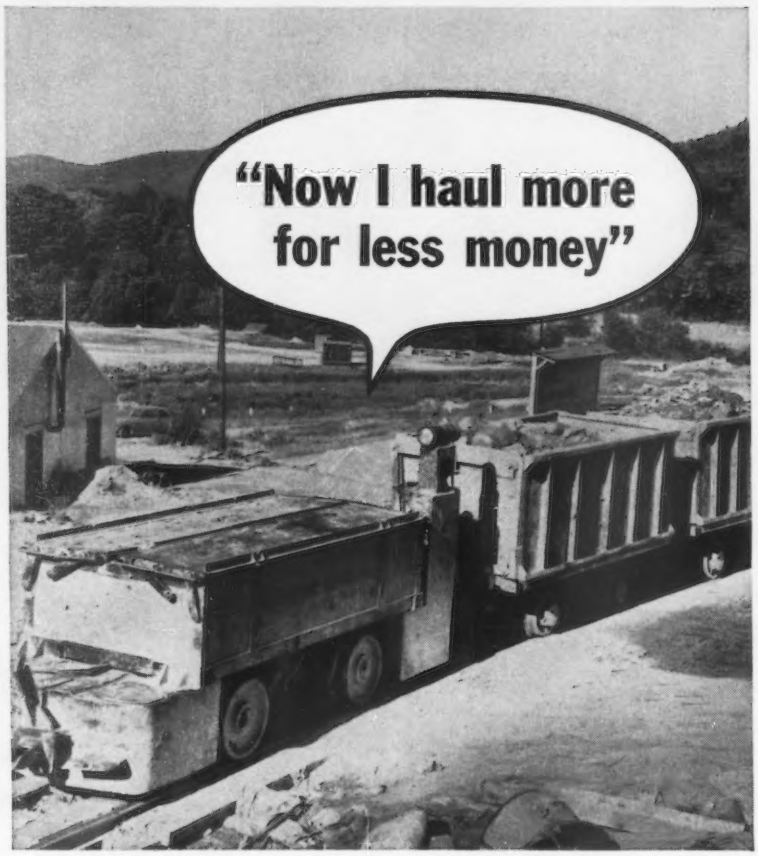
This mark tells you a product is made of modern Steel.




**The owner of this equipment found out that true battery economy** is measured by how much work is done for how long a time . . . not by low price alone. Now he buys Exide-Ironclad Batteries for his locomotives. They last longer and more work can be done, yet the cost per ton is lower. The Exide-Ironclad tubular positive plate is the reason. It exposes more active material for sure, constant power. And the armored porous tubing holds the power-producing material in the plates in spite of the shaking and jolting they are subjected to.

Before you buy another battery, find out how much Exide-Ironclad can save you. Other users find them the cheapest power they can buy—and one thing for sure, you will buy them less often and spend much less in the end. For all the details, write to Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®

## Montana *(Continued)*

tion can become self sufficient.

The mine has received the Award of Honor from the National Safety Council and the Certificate of Honor from the Joseph A. Holmes Safety Assn. The American Chrome Co. is the only underground metal mine in the Northwest to receive this award.

**The U.S. Forest Service is examining the Little Prickly Pear-Wilson Creek area** of the Helena National Forest to determine who has or is engaged in working mining claims that were located prior to July 23, 1955. Supervisor Vern Hamre called it the first step to determine what claims to surface rights on mining claims within the area are valid and effective.

## NEVADA

**W. J. Baker and Joe McKenzie, Lovelock, and Earl Simpson, Winnemucca, shipped 50 flasks of mercury** from their property in the East Range of Pershing County during May. The mine is situated 30 miles east and north of Lovelock, and is reported to contain some of the richest cinnebar in the state. The three owners do all their own work and have two trailers, a cabin, an upright retort, a crusher and a hoist on the property.

**Walter Simmons, Esmeralda County mining man, has started shipments from the Mary Mine,** a big producer of earlier days, situated at high elevation above Silver Peak. Work is being done by open-pit method, and ore is shipped to the U.S. M. & M. mill at Silver Peak. Ore from the Mary contains values in silver and gold. Five men are engaged at the site.

**Standard Slag Co.'s Minnesota Iron mine near Wabuska, 14 miles northwest** of Yerington, is producing an average of 8,000 tons per week, all of which is shipped to Japan. John Harmon, superintendent of the operation, reports that the annual payroll of the mine tops $300,000. Standard Slag supplied the largest cargo of iron ore ever to leave the Port of Stockton during May. It consisted of 21,375 tons, all from the Minnesota property.

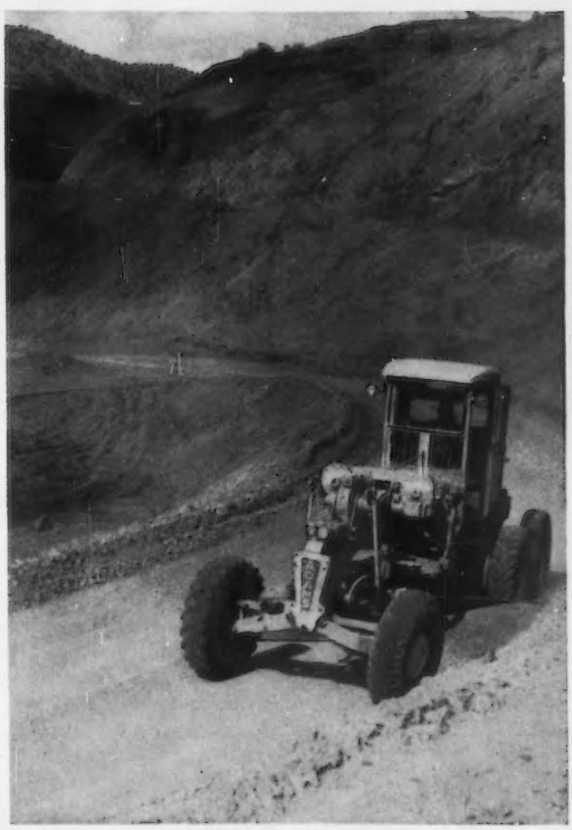
**Tonopah Mining Co's property,** including 15 patented claims, building, maps and equipment, was sold during May to Leroy David and Nick Barbarich. The sale was made by Charles H. Nonamaker, president and treasurer of Tonopah Mining Co., and Gordon D. Stott, director and chairman of the executive committee. The company was organized in 1901 by Jim Butler, who founded the first gold mining camp at the present site of the Nye County seat. The firm produced more than $50-million worth of ore before shutting down operations in 1948. The new owners say they hope to resume mining operations in the near future.

**Getchell Mine Co. during May had 35**

**Production-minded management** keeps haul roads smooth, fast and safe in this large open pit. Benches, pit-floor, dump areas are kept in good shape, too, with this fast-blading LW 660 grader. Constant-mesh transmission gives operator choice of 8 forward and 4 reverse speeds, plus 3 optional "creepers", to get more work done in every gear.

## YOUR BEST PRODUCTION-BOOSTER: **good haul roads**

Actually, it doesn't "cost" to maintain smooth, safe haul roads. *It pays* — in higher average hauling speeds/bigger daily tonnages/lower truck-repair costs. *Quickest* way to patrol your roads, maintain smooth pit-floor and dump areas, is through the *extra speed* you get in LeTourneau-Westinghouse graders. For example, with any straight-shift LW you get 5 to 9 *more* full-power gear ratios than with any other make in its size class. You work 1 to 7 mph *faster*... complete up to 28% more blade-work per day! Or, use a POWER-*Flow*® 550 or 660, and you get infinite speeds up to 27.4 mph, with torque converter *automatically* matching speed and power to any load. How about a demonstration in your pit? Just call your LeTourneau-Westinghouse Distributor. He'll be glad to oblige.



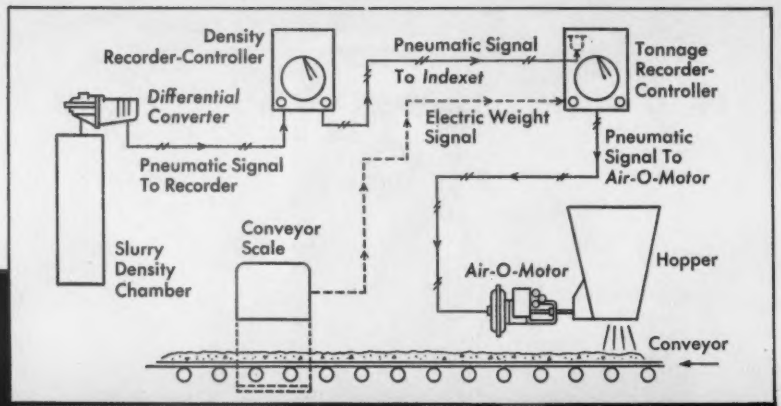
**Over 100 miles** of steep, winding mine roads are patrolled by this LW 550, working 2 shifts a day, 7 days a week, in southwestern copper mine. 4 to 6 operators take turns manning it. It's a grueling assignment, but LW graders have the matched speed, power and structural strength it takes to lick long-hour work schedules.
G-2281-MQ-1

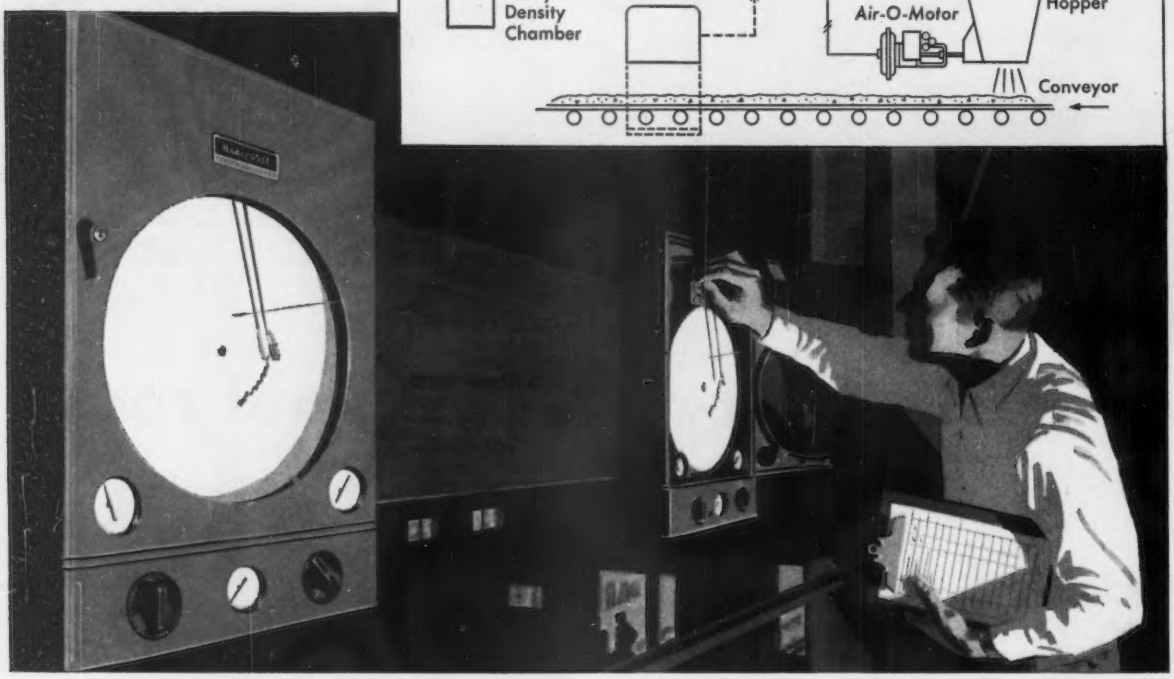
**LeTOURNEAU-WESTINGHOUSE COMPANY,** PEORIA, ILLINOIS

*A Subsidiary of Westinghouse Air Brake Company*

**Where quality is a habit**

Metallurgist at American Smelting and Refining Co. adjusts recorder-controllers that automatically maintain constant density of copper slurry by varying tonnage fed to ball mill.



# Copper slurry density held within ± 0.2% with Honeywell controls

American Smelting and Refining Co., Silver Bell, Arizona, gets excellent classification of copper slurry . . . holds tonnage and copper recovery high by keeping slurry density constant with a Honeywell control system.

Copper-containing ore is mixed with water in a ball mill, and the overflow is pumped to a cyclone classifier. Overflow from the classifier is fed to the flotation section, where the copper is floated off. Between the classifier and flotation section, slurry density is measured by a displacement unit. A *Differential Converter* transmits the density signal pneumatically to a recorder-controller. This instrument, in turn, transmits a pneumatic signal to the *Indexet* unit which automatically positions the set point index of a tonnage recorder-controller. The tonnage controller is actuated by a conveyor scale on the ore conveyor, and operates a pneumatic *Air-O-Motor* actuator on the gate of the hopper feeding the conveyor. While the tonnage controller responds primarily to weight on the conveyor, it is influenced, through the density controller and *Indexet* unit, to add more ore from the hopper when slurry density is not high enough.

Your nearby Honeywell field engineer can help you profitably apply these controls and Honeywell instrumentation for many other metal production processes. Call him today . . . he's as near as your phone.

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SINCE 1885

ONE pump becomes MANY . . . saving you pump dollars . . . giving you a wide range of clear water, non-clog and other liquid-handling modifications . . . when you standardize your pumping operations with Fairbanks, Morse ADAPT-*ABLE* pumps.

*F-M* ADAPT-*ABLES* consist of a pump frame and simple adapter to which can be attached a wide variety of F-M hydraulic ends with enclosed, semi-open or non-clog impellers. Conversion is easy . . . inexpensive, too.

*F-M* ADAPT-*ABLES are "NEMA-Matched":* pump mounting dimensions are standardized with similar dimensions of Nema-driving motors. Gone is the need for make-shift height-adjusting blocks and odd-bore couplings!

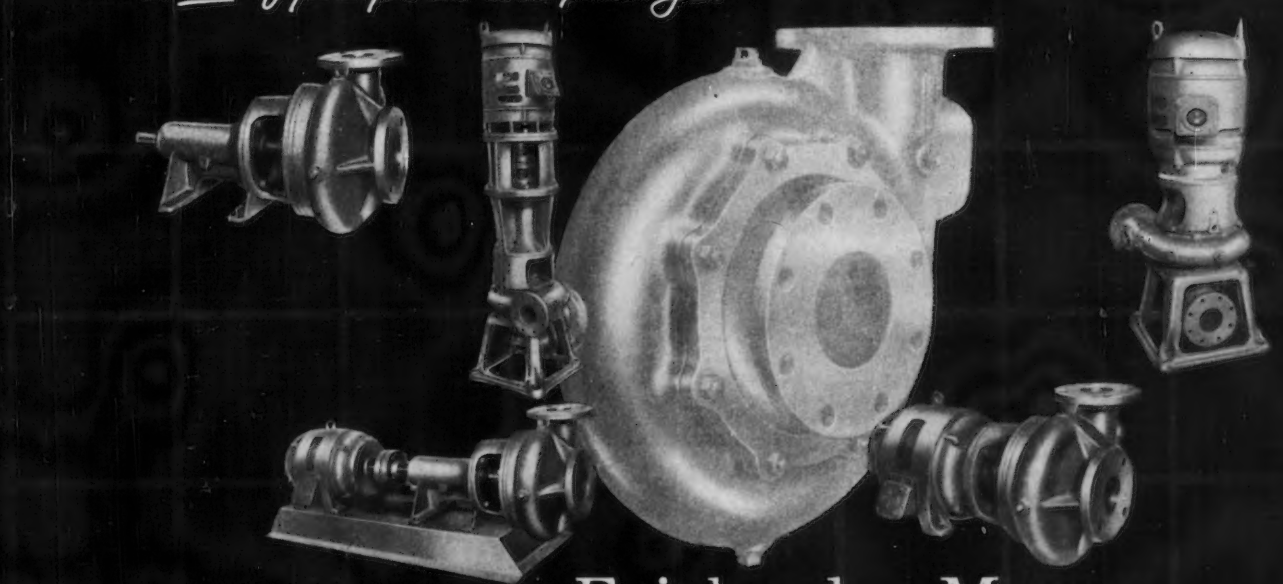
The ADAPT-*ABLE* design means that the most economical frame size may be selected to match the motor horsepower requirements of the pumping job.

And there are other advantages: choice of mechanical seals or conventional stuffing boxes with easy field changeover from one to the other . . . interchangeable bearings for pumps and motors. For special liquid handling problems, hydraulic ends can be specially alloyed to fit the needs: we've been solving such problems for generations.

Regardless of *what* liquids you pump . . . or *where* . . . Fairbanks, Morse builds pumps and *matching* power units for *your* use . . . in a greater range of sizes, types and capacities than *anyone, anywhere.* Start SAVING pump and motor dollars by putting F-M's vast hydraulic experience to work in your plants, process lines and products . . . now!

# "nema-matched" adapt-ables

*. . . a lot of pumps in ONE package!*



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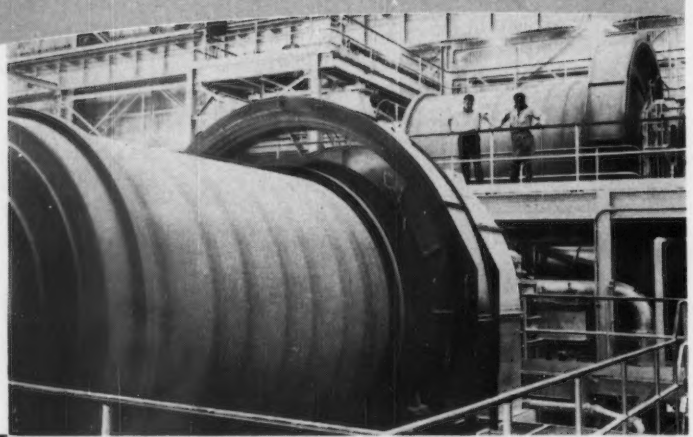
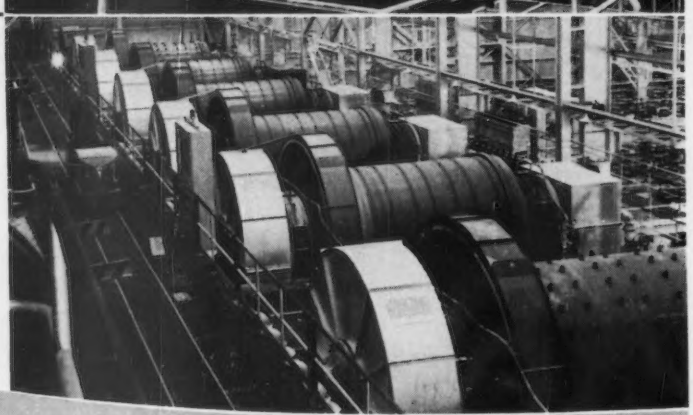
## IS DONE BY 16 MARCY MILLS*

★ 4—10′ x 14′ MARCY OPEN END ROD MILLS
★ 8—10′ x 14′ MARCY GRATE DISCHARGE BALL MILLS
★ 4— 9′ x 12′ MARCY OVERFLOW TYPE REGRIND BALL MILLS



One of the eight 10′x 14′ Marcy Grate Discharge Ball Mills is shown in foreground, and one of the four 10′x 14′ Marcy Open End Rod Mills in the background.



Ball mill section consists of eight 10′x 14′ Marcy Grate Discharge Ball Mills

***For efficient metallurgical performance, and dependable, low-cost mechanical operation, SPECIFY MARCY GRINDING MILLS.***

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*Manufacturing Division*

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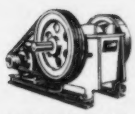
# Laboratory Equipment

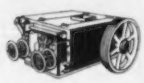


**4"x 6" Massco Laboratory Jaw Crusher**

Welded steel frame; manganese steel jaw and cheek plates; bronze bushed bearings; smooth jaws give better product and easier cleaning. Adjust for plate wear and product size by convenient hand wheel adjustment.

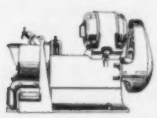
**6" and 10" Massco Gy-Roll Reduction Crusher**

Reduces ½" feed to as fine as 10 mesh in single pass. High capacity, low power consumption.



**Laboratory Crushing Rolls**

Sizes (Diameter x width): 8"x 4", 10"x 6", 10"x 8", 12"x 10" and 12" x 12". Adjustable roll space setting up to ¾". Double V-belt drive. Heavy, cast Meehanite frame absorbs vibration, results in long life.



**Massco-McCool Pulverizers**

Disc type grinder with a planetery movement. No gears. Will grind ¼" to 150 mesh in one pass.

**Marcy Pulp Density Scale**

Gives direct reading of weight; specific gravity of liquids, pulps, and dry solids; percent solids in pulp. Very accurate. Easy to clean.

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OFFICES AND AGENTS IN PRINCIPAL CITIES


## Nevada *(Continued)*

**men doing exploration and development work** at the company's property in northern Humboldt County. Purpose of the program was to determine the extent of ore in the Getchell wide gold vein. One area is in an oxide zone and another in a sulphide zone, and both are known to contain large amounts of ore which were left undeveloped when the company turned from gold mining to tungsten production in the early 1940s. The property has not been producing for the last two years, and George Wingfield Jr., president of the firm, says no plans are held for mining gold. The directors of Getchell Mine Co. agreed recently to sell their property if they can get the right bid.

**Gerald S. Kennedy and Robert G. McCracken were low bidders** on exploration work to be performed for Gold Eagle Mines Inc. on lead-silver property in the Lone Mountain area of Esmeralda County. They are presently deepening the shaft from 180 to 250 ft, excavating 350 ft of crosscut and drift from the 250-ft level. The contract calls for completion of the work in eight months. An O.M.E. loan is helping provide capital for the program.

**Max Magnusson, Winnemucca, has installed a 25-ton mill** in Barber Canyon in Pershing County's east range and is conducting gold operations there which consist of both quartz and placer mining. The mill was moved from a point northeast of the property in Tehama Canton of the Humboldt range. Magnusson has three men working on the project.

**Bognadich Development Co. is operating its 75 tpd mill 24 hr daily near Mountain City** in northern Elko County. Gold-silver ore is produced in the Cold Creek and Rosebud mountain areas and hauled by truck to the mill, which was built early this year. Also constructed at the mill site are bins, a settling vat, scales and assay office. A total of 28 men are employed in the mining and milling operations.

**Eureka Corp. Ltd. and Richmond-Eureka Mining Co. have reached an out-of-court settlement** of the multi-million dollar suit which has long tied up operations at Ruby Hill near Eureka in Lander County. As a result, stockholders of Eureka Corp. Ltd. have approved plans for mineral exploration in that area, which for many years was one of the state's largest producers of lead-silver-zinc ores. Discussion indicated a possibility of making available more than $2-million for exploration work by the Ruby Hill Mining Co., a newly-organized firm, which is owned 75% by Eureka-Richmond and 25% by the Eureka Corp.

**U. S. Steel, through its subsidiary firm Columbia Iron Mining Co., is conducting extensive test drillings** in the areas of Mineral Basin in Pershing County upon which U.S. Steel has taken a two-year option. Previous explorations in the same area conducted last year by the Southern Pacific Land Co. revealed a reported 132-million tons of iron ore. Boyles Bros. Drilling Co., Salt Lake City, is doing the work, and samples taken are being sent to the Colorado School of Mines at Golden for assaying. The area optioned by U.S. Steel is owned by Mineral Materials Co., long-time operators in Mineral Basin, which has ceased operations due to the fact that the company's upgrading mill was also sold to U.S. Steel. At present negotiations are continuing between U.S. Steel and Southern Pacific Land Co. for purchase or lease of the latter's holdings in the same area.

**Jerry Hartley, mining engineer, has resumed operation of his Summit Canyon barite mine** in northern Nye County, and has four men producing ore from the property. The output is being stockpiled at present.

**Mervin J. Gallagher, Nevada Mine Inspector, said during May that the mining industry in Nevada is presently employing 4,800 men** in 145 producing properties. He pointed out that while mining generally experiences an upswing in the spring, the number of properties being worked and the number of men on payrolls is definitely ahead of last year's figures.

**Consolidated El Dorado Mining Co., of Denver, Colo., is conducting two mining operations** in widely separated locations in Nevada. The firm has leased the Northumberland barite mine 75 miles north of Tonopah, and has started an extensive exploratory and development program. And at the New York mine, near Silver City, the firm has four men working at the 850-ft level carrying out a diamond drilling project in the famous old producer of Bonanza Days. The New York, which lies along the Comstock Lode, is leased from the Inspiration Lead Co. of Spokane. Don Jardine is superintendent of the operations.

**Consolidated Eureka Mining Co. increased ore production** at Nevada's Eureka district last year. But the five months strike at the Tooele, Utah, reduction center affected firm's profits.

J. C. Johnson, vice president of the Hogle controlled mining firm, said that exploration and development resulted in new areas of interest being opened up. However, character of the ore declined in lead values at the lead-silver-gold operation. Consolidated Eureka is the only mining firm still actively prospecting and developing at the Eureka district at this time.

"Several new ore bearing structures were found in course of exploration last year and are still being followed with encouraging results," Mr. Johnson said. During the year, 1,475½ tons of ore were mined, containing 1,318 oz of gold; 13,474 oz silver, 251,750 lb of lead, all yielding a net smelter return of $47,230. Development work consisted of 580 ft of raising; 50 ft of winze work; 820 ft of drifting and cross-cutting and 1,985 ft of long hole drilling.

Consolidated Eureka had a loss of a few hundred dollars last year, taking into account federal tax rebates for sev-

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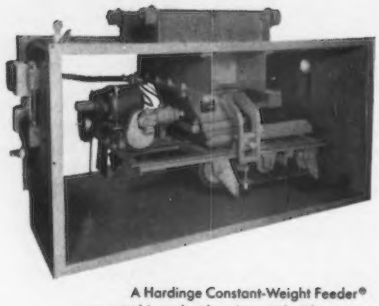
IMPROVED PRODUCTION
... look to Hardinge !

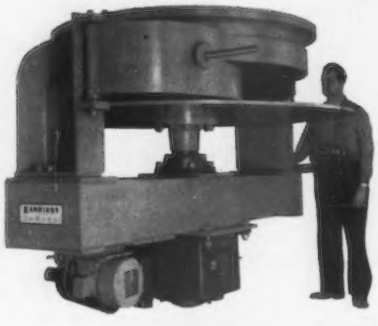
HARDINGE FEEDERS

Hardinge Feeders are available in sizes and types to meet your specific requirements. Constant-Weight Feeders, Volumetric Belt Feeders, Disc Feeders and Rotary Pocket Feeders are offered. All Hardinge Feeders are suspended from feed bins or tracks and need little head room. Costly feeder support structures are unnecessary; equipment following the feeder is readily accessible. When track-mounted, one Hardinge Feeder may serve a number of bins, intermittently.

*For the Hardinge Feeder story, with drawings, photos and detailed specifications, ask for 12-page bulletin No. 33-E-1.*



A Hardinge Constant-Weight Feeder® mounted in a dust housing, with side covers removed. Observation windows are provided in covers. Note track-mounting wheels at top.



84-inch diameter Hardinge Disc Feeder for installation in a lime and cement plant.

Extra-long (96 inch) conveyor type Hardinge Volumetric Belt Feeder designed for bin mounting.

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## Nevada *(Continued)*

eral years. Objective of the firm is to produce sufficient funds from mining newly discovered lead-silver-gold ores to continue exploration for a major structure containing these metals. Such structures were characteristic of the Eureka district in past history.

## NEW YORK

**Ground has been broken for new breaking, screening, and cooling facilities for** the Sinter Plant at the New York Ore Div. of Jones & Laughlin Steel Corp., it was announced by R. Grant Fleck, J&L's New York Ore Div. manager. The new facilities, which are being installed by Dravo Corp., Pittsburgh, include a vertical shaft stationary cooler —the first of this type to be installed in the U. S. Capacity of the new unit will be 3800 gross tpd of product.

This is Dravo's third contract with J&L for sinter equipment. A circular cooler was installed at J&L's Cleveland sinter plant, and a complete plant with a single 13-ft 2-in.-wide strand—largest in the world—is under construction at the Aliquippa (Pa.) Works.

## NORTH CAROLINA

**The Cranberry Iron Mines in Avery County, N. C., are back in production** after a quarter of a century, and ore from one of the mines will be converted into sponge iron and high grade steel at an electric smelting furnace to be built within the next 10 months in Carter County, Tenn., about 23 miles away. The electric smelter furnace, to cost $4-million, reportedly will be the only one of its kind in the U. S. and will be operated by the recently formed Cranberry Iron & Steel Co. of Washington, D. C.

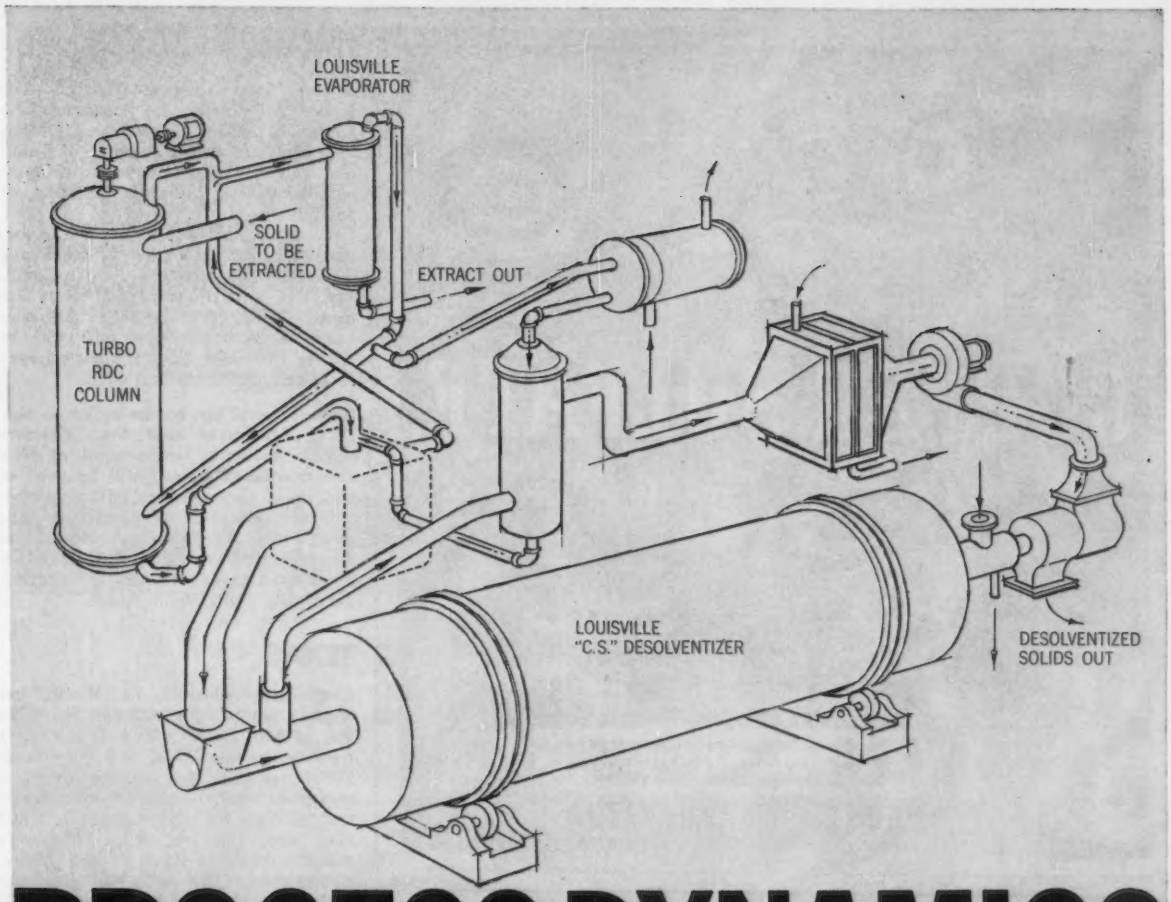
Announcement of plans to build the smelter was made by N. T. Nixon, president of Cranberry Magnetite Co., which is operating the mines, and of the Appalachian Exploration Co. which, with Cranberry, has 6700 acres in N. C. and Tenn. under a 40-year lease. The ore deposits extend about 25 miles from Cranberry into Tenn. Cranberry will deliver 400 tpd of ore to the electric smelter when it goes into operation and the smelter will operate 24 hr a day with about 30 men in its employ.

## TENNESSEE

**A large new zinc mining operation is under way in Jefferson County.** Tri-State Zinc Inc., subsidiary of Consolidated Gold Fields of South Africa Ltd., has an option to purchase a large zinc

### Correction

In the April issue, p 202, E&MJ failed to correctly identify the leading producer of manganese ore in 1959 as the Turner Mines, of Embreeville, Tenn.

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Our engineers, with their broad experience in equipment and process specialties, are ready to work with yours to provide any of the listed equipment and systems, and to install them anywhere in the world.

Unified responsibility as provided by General American means greater efficiency, fewer complaints, improved coordination and far less down-time than you can possibly get when your equipment is furnished by a variety of suppliers.

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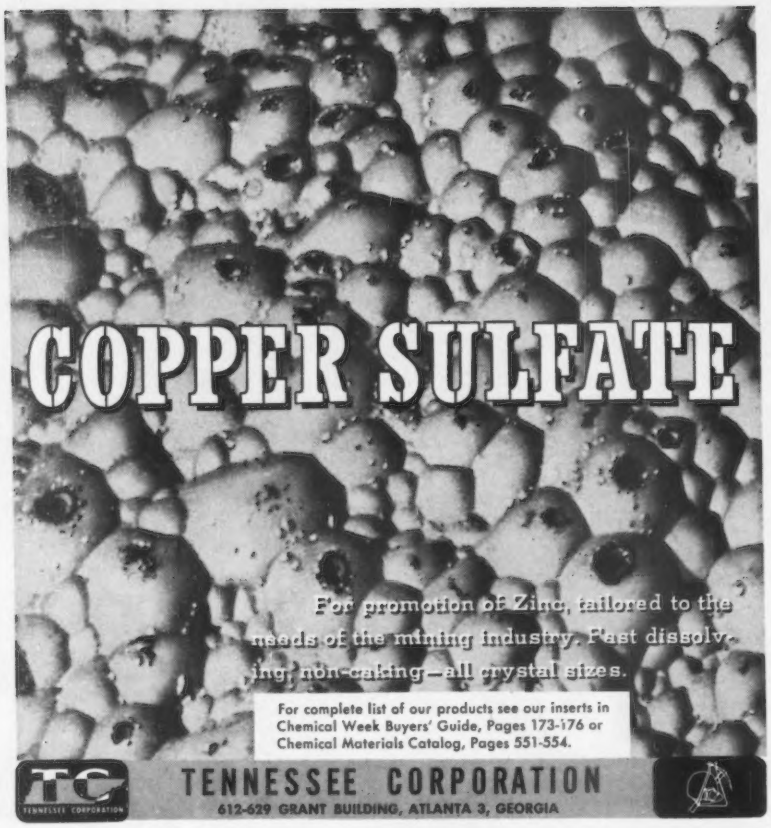
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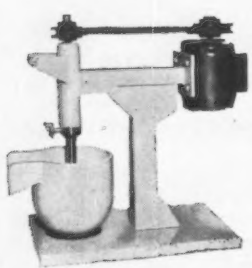

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MINERALS SEPARATION • RESEARCH • EQUIPMENT • PLANT OPERATION

## Tennessee *(Continued)*

orebody from American Zinc Co. The orebody, discovered by American Zinc geologists through the aid of a DMEA loan, has an indicated reserve of 1-million tons of zinc concentrates. At present prices, this indicates a value of $80-million.

Tri-State Zinc expects to spend between $3- and $4-million in developing the mine and erecting a 3600 tpd mill. Joy Mfg. Co. is completing fill-in diamond drilling for Tri-State. All concentrates from the new mill will be sold to American Zinc for their smelters in Illinois, Arkansas and Ohio.

**Foote Mineral Co. has an option to purchase 640 acres near the** Tennessee Valley Authority steam plant at New Johnsonville. The land will be used as the site of Foote Mineral's third electromanganese smelter in Tennessee. The other two smelters are located at Knoxville. All manganese ore used at Foote's Tennessee smelters is imported, principally from South Africa.

## TEXAS

**Continental Minerals, Ft. Worth, has recently purchased a mill site 5½** miles east of Van Horn in Culberson County for construction of a mill to process barite ores from their Apache Mountain properties located about 18 miles northeast of Van Horn in the Seven Heart Gap area. The ore ranges from pure massive barite to interlayered barite-calcite rock. The mill will have an initial capacity of 80 to 100 tpd (1 shift) and will utilize Wilfley tables and flotation cells to produce a —325 mesh 4.3 sp gr product for use in drilling fluids. According to Foster Howell, vice president, construction started July 1.

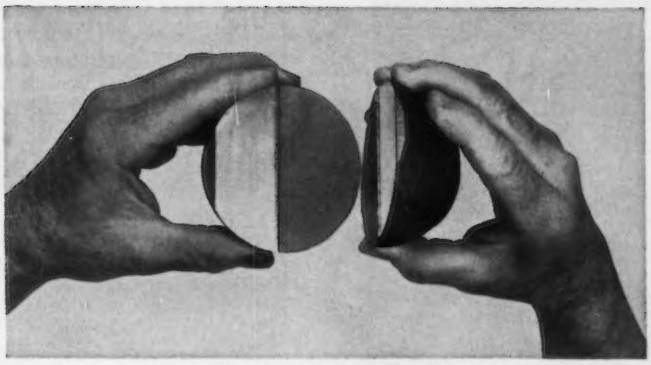
## UTAH

**Utah District Judge Fred J. Keller has held** that when a mining company formally abandons a claim for tax or other reasons, it cannot later transfer those properties to another party.

Judge Keller resolved a controversy over ownership of a producing open-cut uranium mine on top of the famous Delta property discovered by Vernon Pick in Emery County in favor of Maxwell Bentley and Ralph J. Hafen, two Salt Lake lawyers. He ruled that some of the placer claims that Kay and Jeanine Hunt of Hanksville and Green River had received in quit claims from Hidden Splendor Mining Co. weren't valid after it had abandoned the Delta which financier Floyd Odlum bought from prospector Pick for $9.5-million.

**Machinery Center Inc. has sold a 200-tpd manganese sintering plant** to the Cuban government. Best guess is that the Cubans, who have taken over all manganese operations on the island under the Castro regime, will use the facility to up-grade present manganese concentrates.

**Utah Construction & Mining Co. will**



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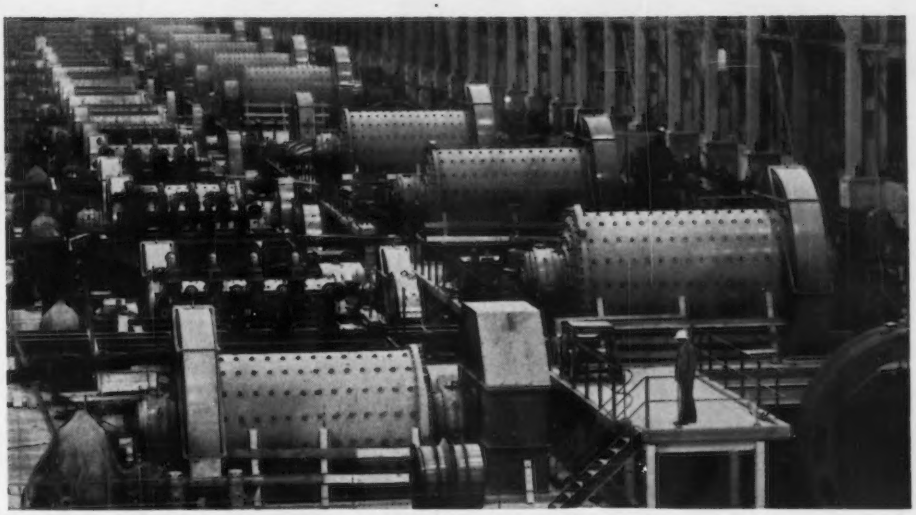

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New Issue June 3, 1960

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**Engelhard Industries, Inc.**

**Common Stock**
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**Price $23 per Share**

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**Dillon, Read & Co. Inc.** **Lazard Frères & Co.**

## Utah *(Continued)*

**build a** $1.9-million iron ore beneficiation plant at its Iron Springs mine. Purpose of the beneficiation unit is to maintain grade between 52 to 54% Fe, or better, in connection with U-C's long-term contract for sale of ore to Geneva Works of U.S. Steel Corp.

**Texas Gulf Sulphur Co. announces favorable results** from its first test well on potash leases in southeastern Utah. The well was completed one month following the signing of an agreement under which Texas Gulf will acquire and commercially develop the extensive Utah potash properties of Delhi-Taylor Oil Corp. The latter will retain a 25% interest.

Texas Gulf used compressed air rather than mud as the drilling and coring medium. This is believed to be the first successful use of air in the coring of salt and potash. This technique speeded drilling, eliminated leaching and led to 100% core recovery in the potash zone.

## WASHINGTON

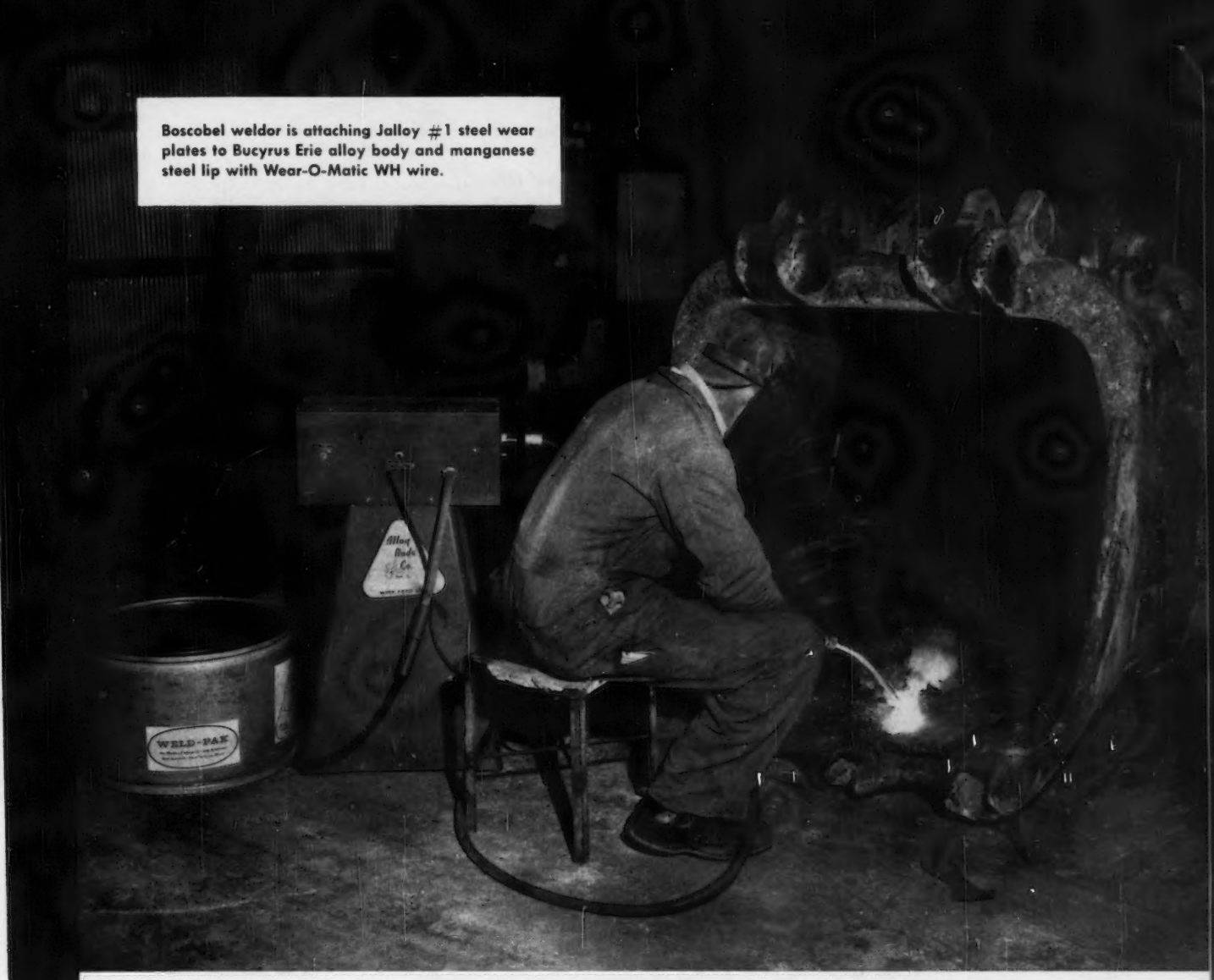
**Dawn Mining Co., Spokane, a subsidiary of Newmont Mining Corp.,** New York, said it will purchase uranium leases now owned by Silver Buckle Mining Co., Wallace, Idaho, and located on the Spokane Indian reservation. Purchase price for the leases, which cover about 320 acres, is $1-million. The company plans to begin an exploration and development program this month that is expected to step up production at the reservation.

**Rehabilitation work on the main adit of the old Schumaker silver-lead-zinc mine** in the Joe Creek area near Colville has been started by Triton Mining Co. Cline E. Tedrow, Spokane, consulting engineer for the firm, said a crew has started cleaning up work and retimbering the 300-ft tunnel. Drifting work is being planned.

Water is being pumped from a 30-ft winze to permit ore sampling at the bottom and possible deepening of the winze. The firm also is planning to begin work at the Kelly Camp mining property in Ferry County, where flotation cells will be installed at the gravity-type mill.

**Silver Hill Mining Co., Spokane, is purchasing an old tungsten property** on Moran Prairie, south of Spokane, from Spokane Tin Mine Co. Daybreak Uranium Inc., Spokane, has an interest in the new venture. The firm plans to mine and mill tungsten ore at the 132-acre property.

**Clayloon Uranium Co., Spokane, is moving a 1,000-tpd ore concentrator** from Spokane to its Lead Trust mine lease in Stevens County. The mill equipment is being moved in, officials said, to be set on mill foundations which were constructed this spring and a mill building will be constructed over the equipment later in the summer. Testing of the specific gravity type concentrator will begin in July. Clayloon leased the




Boscobel weldor is attaching Jalloy #1 steel wear plates to Bucyrus Erie alloy body and manganese steel lip with Wear-O-Matic WH wire.

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*"Wear-O-Matic WH is the most versatile welding wire for bucket maintenance because it provides high strength welds in any of the popular alloy steels and has excellent resistance to impact when used for build-up work. Savings in time and labor through the semi-automatic open arc application of this wire have resulted in less bucket down time and lower costs."*

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**TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES**

## Washington *(Continued)*

Lead Trust property last year. Since then development work has uncovered a wide vein of lead ore and the firm has drilled 14,000 ft of test holes in depths up to 136 ft. Officials of the firm said that about 60,000 tons or ore is now ready for milling.

## WISCONSIN

**The North Western Railway Co. said June 15 it would appeal** an Interstate Commerce Commission ruling suspending a proposed reduction in ore dockage rates at Escanaba, Mich.

North Western had planned a dockage rate of 11c a ton on iron ore, where no additional services such as storage, mixing or blending were required. The present rate of 19c a ton includes these services.

Objections by the city of Ashland, Wis., preceded the ICC suspension of the rate cut. North Western had early in April reduced its line haul from the Gogebic Range to Escanaba from $2 to $1.45 a gross ton. That reduction was permitted to stand, despite objections from Ashland, which previously had shipped much of the Gogebic ore.

# IN CANADA

## BRITISH COLUMBIA

**Bethlehem Copper Corp. Ltd. is proceeding with three diamond drills** at its Highland Valley property to test the ore potential of the "A" zone and to add to information on the extent of the Jersey zone. Results will have a bearing on the size of the open pit which will be a feature of the Bethlehem operation now being prepared by the company in collaboration with technical representatives of Sumitomo Shoji Kaisha Ltd. Bethlehem has agreed to sell all its copper concentrates to the Japanese company for 10 years in return for financing to production. H. H. Huestis, president, said this would cost about $7.5-million, including a mill with an initial capacity of 3,000 tpd.

**Howe Sound Co. reports good exploration progress** at its Britannia copper-zinc mine. Estimated copper reserves are placed at 1.4-million tons which average about 2% copper per ton, and the zinc potential is attractive. One phase of the exploration program has indicated a favorable mineral structure, but conclusive results on reserves may take a year.

**Westfrob Mines Ltd., a Frobisher subsidiary, is ready to go ahead** with development of the Tassoo Inlet iron ore deposits on Moresby Island, in the Queen Charlotte Islands, "just as soon as the existing legislative barriers are removed." Negotiations have been going forward with Japanese interests for sale of the ore and satisfactory progress has been made. Present indicated reserves total 4.9-million tons grading 57.3% iron and 0.59% copper.

**Pato Consolidated Gold Dredging Ltd. reported reduction in yardage and returns last year** due to Dredge No. 4 being out of production for 7½ months while on its flotation move to a new site. Over-all recovery per yard was down 2.12c to 16.7c in 1959. Estimated reserves at year-end were 439,288,000 cu yd of gravel with average valuation of 15.5c. Pato has abandoned exploration at its Brazil gold and diamond property and also its property in British Guiana.

**Silbak Premier Mines, near Stewart, has shipped its first consignment** of high grade gold-silver ore for 1960 to the Montana smelter of American Smelting & Refining Co. It consisted of 250 tons of cobbed ore.

## NEWFOUNDLAND

**Maritimes Mining Corp. has completed shaft deepening** at its Tilt Cove copper producer. The shaft was taken from depth of 884 ft to 1980 ft to open six new levels and preparations are now in progress to start driving out on the first of the new levels at the 850-ft horizon. In 1959 net profit was $1,623,038, more than double that of the previous year. Ore reserves at the end of the year amounted to 3,530,000 tons grading about 2% copper and 0.023 oz gold per ton.

**Atlantic Coast Copper Corp. has scheduled production** at its Little Bay copper property to start about March 1, 1961. Milling rate will be from 800-1,000 tpd. Ore reserves are estimated at 2,610,000 tons averaging 2.11% copper.

**Labrador Mining & Exploration Co. is planning its own concentrating plant in the Wabush Lake area.** The plant will be separate from that being constructed on Labrador ground by Iron Ore Co. of Canada (Ioco). Iron Ore has decided to increase the capacity of the planned Carol Lake beneficiating plant at Wabush from 6- to 7-million tons of concentrate annually. Start of production is scheduled for mid-1962 by which time Ioco's production will be boosted from 10- to 13-million tons annually. Construction of a branch railway to serve the Wabush area was completed in May. Driving of two 800-ft adits at the Wabush No. 5 mine has been started.

## ONTARIO

**Siscoe Mines, subsidiary of Siscoe Metals of Ontario, is turning out a record flow of silver** from its veteran producer in the Gowganda area. The mine which has been in production for over half a century, is continuing to disclose ore at a comfortable pace with enough ore in sight at present for at least three years' operation. The mill is handling about 240 tpd with heads averaging 20-25 oz silver per ton.

**Pronto Uranium Mines,** former uranium producer in the Elliot Lake camp, has set its sights for production of copper concentrates from the Pater property near Spragge by the end of this year. The company is one of those being amalgamated to form Rio Algom Mines. Plans call for milling rate of 500 tpd with ore to be trucked to the present Pronto plant some two miles away. New concentrating equipment is to be installed to treat the copper ore.

**Faraday Uranium Mines is producing at a steady rate of 65,000 lb uranium oxide per month** from its Bancroft operation. This rate is expected to be maintained until the present $45-million contract with Eldorado is completed in 1962. The mill is handling some 1200 tpd with heads averaging about 1.8 lb uranium oxide per ton. There is now sufficient ore in sight above the 750-ft level to complete the contract but the company is continuing to carry out a limited amount of exploration near the shaft on the 900-ft level.

**H. G. Young Mines expects to start milling operations for its Red Lake area gold property by August** this year. This will mark the first new gold producer for the Red Lake camp in over 10 years. The former Starratt Olsen mill is being purchased and ore will be trucked some 16 miles from the Young mine for treatment. It is expected that initial rate will be 250 tpd but with small addition the mill could be increased to 500 tpd. Work to date has indicated about 270,000 tons of ore with estimated uncut grade of 0.41 oz or a cut grade of 0.31 oz gold per ton. Only a portion of one of the company's 19 claims has been explored so far.

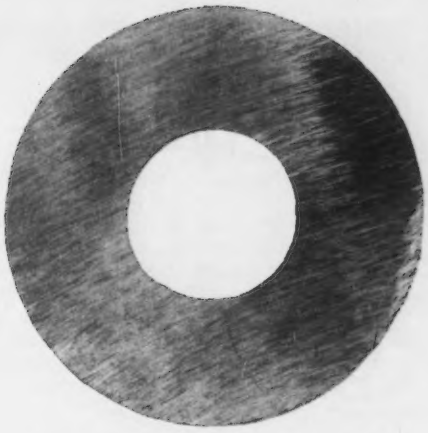
**Cochenour Willans Gold Mines,** Red Lake area gold producer, has shattered its own record for the fourth consecutive year. Production edged up in 1959 to a new top at 67,699 oz gold compared with 63,001 oz in 1958. A whole new ore structure has been indicated in the west zone and work is being continued to explore this area.

## QUEBEC

**Preparations are under way to sink a 3-compartment shaft** at the Solbec Copper Mines' copper-zinc property in the Eastern Townships. Decision has been made to put the property into production at 1,000 tpd. Clearing of the mill site is now being carried out. The company is a wholly-owned subsidiary of Hastings Mining & Development Co., which in turn is controlled (84%) by East Sullivan (50%), Sullivan Consolidated (20%), and Quebec Lithium (30%). Surface drilling has indicated over 1-million tons averaging 2.16% copper and 3.9% zinc plus gold and silver to depth of 500 ft.

**Opemiska Copper Mines turned in a record performance in the first quarter** of this year with earnings more than double those of the same quarter a year ago.

Cross section of average extension steel, showing distorted center hole.



Cross section of Sandvik Coromant Steel, showing perfectly uniform center hole.

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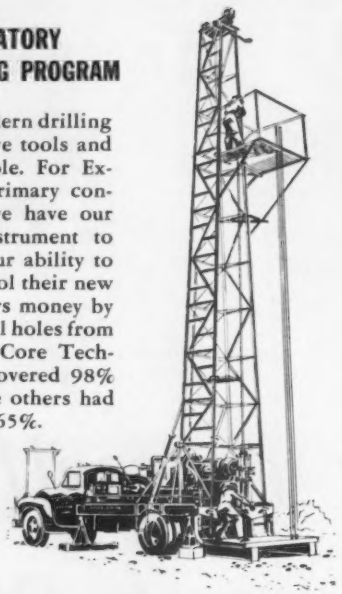

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## MANITOBA

**Some 218 claims have been staked** along the southwest extension of the "Mystery-Moak structural feature" by National Malartic Gold Mines Ltd. and Consolidated Marbenor. Both firms are part of the Hirshhorn interests.

# IN LATIN AMERICA

## JAMAICA

**Aluminum Co. of America has exercised an option covering mining rights** on 30,000 acres of bauxite bearing lands in Jamaica.

The site, which Alcoa will develop over the next three years, is in Clarendon Parish, west of Kingston and 15 miles from Jamaica's south coast. Alcoa optioned the area 10 months ago by agreement with the Jamaican Government and Caribex Ltd., a wholly-owned Canadian subsidiary of American Metal Climax Inc.

## BRAZIL

**Brazil, now near the zero mark in production of zinc, will soon be turning out nearly 30,000 tpy,** thanks chiefly to industrialist Jose Erminio de Moraes, Brazil's No. 1 aluminum producer.

Moraes and his associates will invest a billion cruzeiros (about $5.5-million at the present free rate of exchange) in the next two years to build a zinc refinery near the new Tres Marias hydroelectric plant on the Sao Francisco River between Belo Horizonte and Brasilia.

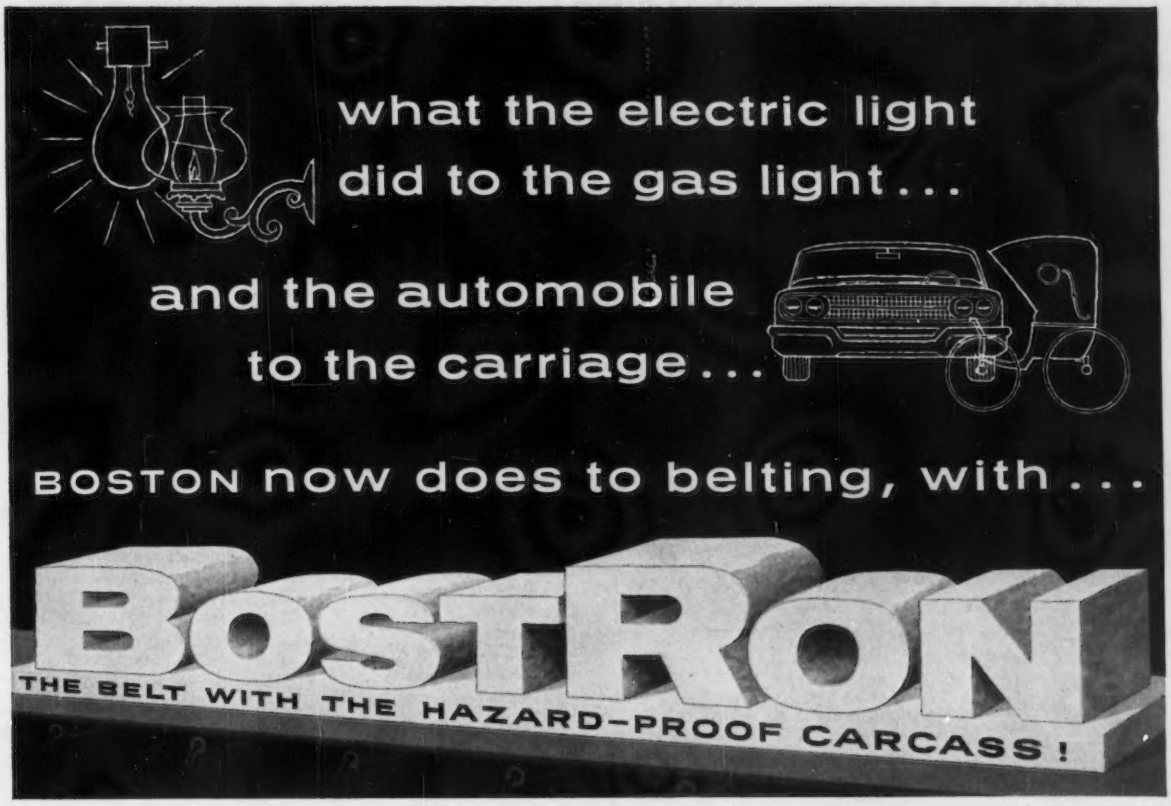
Already under construction, the refinery will have a capacity of 20,000 tpy during the first stage of the project, to be concluded by mid-1962. In the second stage, due for completion by 1964, output will rise to 50,000 tpy.

Brazil's only zinc producer at the moment, Cia. Mercantil e Industrial Inga, with production of 60 tpy at a pilot plant near Rio, is installing equipment to permit an output of 5,000 tons annually by next year.

## CHILE

**Compañía Minera Merceditas is reconstructing its 150 tpd copper flotation mill** at El Volcán near Santiago which was practically destroyed when the Cajón del Maipo earthquake took place two years ago.

**The Administration took over the operations of the mechanized nitrate plant of Victoria,** Tarapacá province, by placing the complete operation of the mines and plant under the surveillance of the Director of Chilean Bureau of Mines.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did to the gas light...
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THE BELT WITH THE HAZARD-PROOF CARCASS!

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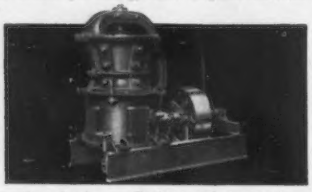
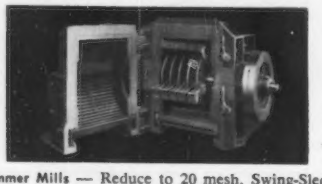
**Jaw Crushers** — Produce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smallest sizes operate on double cam principle — crush double per energy unit. *Request Bulletin No. 062.*



**Rotary Fine Crusher** — Reduce soft to medium hard 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Non-clogging operation. Single handwheel regulates size. *Request Bulletin No. 063.*

**Crushing Rolls** — Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls; Plain Balanced Rolls; Laboratory Rolls — all may be adjusted in operation. *Request Bulletin No. 065.*



**Hammer Mills** — Reduce to 20 mesh. Swing-Sledge Mills crush or shred medium hard material up to 70 tph. Hinged-Hammer Pulverizers crush or shred softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers with feed openings from 12 x 12 in. to 12½ x 24 in. *Request Bulletin No. 084.*

**Reports Manager W. Carleton Merrill concerning Sturtevant Swing-Sledge Mill at James F. Morse Co., Boston.*

**STURTEVANT**
**MILL COMPANY**
**101 Clayton St., Boston 22, Mass.**


# IN AFRICA

**Rhodesia Broken Hill Development Co. in Northern Rhodesia** which plans to install an Imperial smelting furnace estimates the cost at £4-million ($11.2-million), including additional housing. The development is expected to be completed by 1962 and will involve the installation of a third generator at the Lunsemfwa hydro-electric site. The process is expected to improve the combined recovery of lead and zinc from about 60% to over 85% from ore mined and also make possible the recovery of some 200,000 long tons of metals from stocks which are now untreatable. About £400,000 ($1.1-million) has already been spent on securing rights and designs for the smelting process.

**Installation of a new milling plant** by M.T.D. (Mangula) Ltd, a copper producer in Southern Rhodesia, and other developments have led to a reduction approaching 10% in operating costs. From an average of $3.90 per ton of ore treated in 1958 the costs were reduced to $3.54 last year. During the company's last financial year, ended Sept. 30, the tonnage of ore milled was 736,400 tons from which 8,384.8 short tons of copper were produced.

## PHILIPPINES

**Acoje Mining Co. earned about $750,000 in 1959 from sales of its chromite concentrates to Japan,** which was the only buyer. Barter agreements helped out on the profit which was three times as large as the previous year. U. S. buyers were out of the market during 1959. Over 276,000 metric tons of ore were milled from which 125,000 tons of metallurgical grade chromite concentrates were produced.

**Consolidated Mines, largest producer of refractory grade chromite ore in the Philippines,** sold 526,000 tons of ore and concentrates in 1959, valued at $10.8-million.

**Lepanto Consolidated reported that sales and earnings in 1959 were higher** as a result of better copper and gold prices. Total ore reserves at the end of the year were 4,691,000 tons, averaging 3.3% copper and 0.13 oz gold per ton. This was slightly better than a year earlier in spite of mining 455,000 tons during the year. Copper production was 14,419 tons, gold totaled 47,229 oz, and silver 196,900 oz. C. B. Foster is general superintendent of Lepanto, L. S. Dahners is mine superintendent, and H. E. Brown mill superintendent.

# IN AUSTRALIA

**Three Japanese aluminum producers have ordered trial shipments of 10,000 tons each of bauxite** from Western Aluminium's N.L. deposits in the Darling Ranges in Western Australia. It is expected that successful acceptance of the trial shipments will lead to orders totaling about 300,000 tpy and the possibility of Japanese interests investing some amounts in the exploration of the bauxite deposits.

**Frank Samuel & Co. Inc. is a partner with the Western Australian firm of Garrick Agnew Pty. Ltd.** in a new company named Basic Materials Pty. Ltd. which will develop the extensive and hitherto neglected magnesite deposits in Western Australia.

The deposits are in the Ravensthorpe area and a sale of 50,000 tons of magnesite was already made even though production is unlikely to start before September 1960.

## Personals *(Continued)*

technology; **E. O. Sommer, Jr.,** treasurer; **Leo Teplow,** assistant vice president; and **F. A. Coombs,** assistant secretary.

**A. S. Glossbrenner** was elected a director to fill the vacancy caused by the resignation of **J. L. Mauthe; V. W. Scully** will replace **H. G. Hilton.**

**R. L. Gray,** Mr. Hilton and Mr. Mauthe were elected honorary vice presidents.

**Edward Duffield McDermott** and **Julius Kruttschnitt** have been honored for their distinguished services to the mining industry by the Institution of Mining & Metallurgy. They received the Institution's Gold Medal for 1959 at the annual meeting held recently in London.

Other awards presented were:

The Consolidated Gold Fields of South Africa Ltd. Gold Medal to **Sydney Charles Newman.**

The Consolidated Gold Fields of South Africa Ltd. Premium of Forty Guineas to **Felix Mendelsohn.**

The "Arthur Claudet" Student's Prize to **Henry Neville Rhoden.**

**Prof. Antoine Marc Gaudin** of Massachusetts Institute of Technology was recently elected chairman of the Engineering Foundation, a department of United Engineering Trustees Inc. He succeeds **W. M. Peirce.**

**George O. Curme, Jr.,** a director of Union Carbide Corp., has been elected vice chairman, with **Dr. H. K. Work,** associate dean and director of research at New York University, being named director of the foundation.

**Carl W. Borgmann** of the Ford Foundation is a newly elected member of the executive committee.

New members of the Board are **Augustus B. Kinzel** and **John H. Hitchcock.** Dr. Kinzel is vice president-research, Union Carbide Corp., and president of Engineers' Joint Council. Mr. Hitchcock is chief mechanical engineer of the Morgan Construction Co.

**Dr. John L. Mero** has received the first D. C. Jackling Post-Doctoral Fellowship for advanced studies in mining.

The $5,000 grant will enable Dr. Mero to continue his studies of deep sea mineral deposits on the ocean floor.

# AT HOME ON THE "RANGE"

If there's an 9-yard mining shovel in your future, make it a Marion 181-M.

Here's a husky machine with the traditional strength, power and endurance of Marion mining shovels—plus small machine cycle time for an extra payoff every day.

The 181-M has a combination of design, construction and performance features that can lower your costs and add to your profits.

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*A Division of Universal Marion Corporation*

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Tel.: RENTIERS—Telex: 3169.

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Milling Plants — Appraisals
Plant Layouts — Plant Design
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JO 1-1828 (Code 914).

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*Mining Consultant*
MEXICO
Apdo. Postal 54
Caborca, Sonora, Mexico
Telephone #9

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Consulting Engineers for all types of Aerial Tramways, Cableways and Suspension Structures.
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120 Broadway, New York 5

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Group Hole Drilling and Pressure Grouting Diamond Core Drilling
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11 Broadway, New York 4, N. Y.
Cable Address—BEHRDOL

**C. P. KEEGEL**
*Mining and Metallurgical Engineer*
Administration — Appraisal
1721 So. 14th St., Las Vegas, Nevada
Telephone DUdley 4-6981

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Mineral Prospecting
Pressure Grouting for Shafts-Tunnels
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826-846 Eighth Ave.
Huntington 1, W. Va.

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24 Union Block—Phone HI 5-0610
P. O. BOX 1512
Prescott, Arizona

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Barr and Associates
Consulting Engineers
P.F. 942, Belgrade, Jugoslavia
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**KIRK & COWIN, INC.**
*Consulting - Reports Appraisals*
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Phone ST 6-5566

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PRIVATE OR PUBLIC
Tel. OY 6-3660
Oyster Bay, N. Y.

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*Mining Consultants*
165 Broadway — New York 6, N.Y.
BArclay 7-6960
Cables: EXAMIMINES

**EARL C. VAN HORN**
*Consulting Geologist*
Mining & Engineering Geology
Box 7, Tel. VE 7-2048, Murphy, N.C.

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Ore Shippers representatives at Local Plants
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1300 West Main St. — El Paso, Texas

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Ore Testing
Box 430 — Phone OLiver 2-3341
Lakefield, Ontario, Canada

**PENNSYLVANIA DRILLING COMPANY**
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Mineral Prospecting
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1205 Charters Ave., Pittsburgh 20, Pa.

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*Mineral Engineering Consultants*
3715 E. Trent Avenue
Spokane, Washington
Cable: Wilmet — Phone: Ke 55148

**E. D. GARDNER**
*Mining Consultant*
Mining Appraisals—Mining Methods
200 N. Wayne Street, Arlington 1, Va.

**LEDOUX & COMPANY, Inc.**
Metallurgical Chemists — Assayers
Spectroscopics
Representatives of Shippers of Ores and Metals at Buyers Works
Mine Examination Analyses
359 Alfred Ave., Teaneck, N. J.

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*Consulting Mining Engineer*
Telephone MAin 1-1421
705 Chestnut St., St. Louis 1, Mo.

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YUkon 2-1436
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10809½ Strathmore Drive
Los Angeles 24, California
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Minneapolis 10, Minn.

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808 Newhouse Bldg. Salt Lake City, U.

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Mining and Consulting Engineer
Examination—Valuations—Management
3 Glenwood St. Little Neck 63, N.Y.
Cable: MINEWOLF
HUnter 2-7843

**ABBOT A. HANKS, INC.**
*Assayers—Chemists*
Est. 1866
Spectographic Analysts
Shippers Representative
1300 Sansome Street, San Francisco 11

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705 Judge Building
Salt Lake City 11, Utah

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Houston, Texas
Tel.: MO 5-7079

**WOLFE & ASSOCIATES**
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6518 Ledbetter — Houston 17, Texas
Tel. OLive 4-1322 — Cable—WOLMAC

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Selling Opportunities Offered

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Subject to Agency Commission.

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Position Wanted—The rate is one-half of the above, payable in advance.
Box Numbers—counts as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Not subject to Agency Commission.

**Send NEW ADS or Inquiries to Classified Advertising Div. of ENGINEERING & MINING JOURNAL, P.O. Box 12, N. Y. August issue closes July 21st.**

WANTED

## Maintenance Engineer

With established background capable of complete charge of maintenance at Texas quarry and processing operations. College graduate preferred but not essential. Age 30-50. Submit complete resume, including education, experience, references, and salary requirements in confidence to:

**P-4700 Engineering and Mining Journal**
**520 N. Michigan Ave., Chicago 11, Ill.**

## FLORIDA OPPORTUNITY

Metallurgical or Chemical Engineer with ore dressing background. Will require several years experience in flotation processes and materials handling (wet and dry). Fine opportunity for growth and development with leading phosphate firm located in Central Florida. Age 30-40. Submit full details of qualifications, experience, and minimum salary requirements to Personnel Supervisor, P. O. Box 1115, Bartow, Florida.

*ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.*
*NEW YORK 36: P. O. BOX 12*
*CHICAGO 11: 520 N. Michigan Ave.*
*SAN FRANCISCO 4: 68 Post St.*

### POSITIONS VACANT

**Position Open—Operations Research Engineer—** Medium sized nonmetallic processing plant fine grinding and materials handling experience desirable. Should have training in mineral processing and minimum of three years experience. Northeast. Submit complete record. P-2674, Engineering & Mining Journal.

**Sales Engineer. Preferably metallurgical. Ex**perienced in selling grinding and allied process equipment. Must have capacity to handle large accounts. Free to travel. Position of responsibility with substantial manufacturer enjoying long time international reputation. Also, an opportunity for a sales trainee on same equipment. Western U.S. Our employees know about this advertisement. P-4590, Engineering & Mining Journal.

**Engineering Draftsman—Experienced in mapping** and surveying and all the mathematical computations related to the above. Must do neat and accurate work. Southern Virginia Location. Permanent. P-4619, Engineering & Mining Journal.

***When Answering***

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## GENERAL MINE FOREMAN

B. S. in Mining Engineering. Position also requires fluent knowledge of Spanish and English. Should have several years in responsible supervisory position in underground mining, preferably block caving. Primary function would be to translate into execution all planning and coordinate all operations required for the mining of 34,000 tons daily.

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P-3845 Engineering & Mining Journal
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

### POSITIONS VACANT

**Mining Engineer. Background in project evalua**tion and mine operations; metallics or industrial minerals. Capable of selecting mining methods and equipment for various types and sizes of operations and developing cost data for economic evaluations. Degree and minimum seven years experience, plus report writing ability. Location: Colorado. Salary open. Send complete details and snapshot to P-4623, Engineering & Mining Journal.

### POSITIONS WANTED

***Superintendent — Mining or Construction.*** E.M. degree 1947. Experience underground mining, surface plant construction, shaft sinking. Registered P.E. (Utah). Resume on request. PW-3291, Engineering & Mining Journal.

**Superintendent-Mining Engineer. Experienced in** exploration, shaft sinking, mine development and construction. Employed, good health, age 37. PW-4598, Engineering & Mining Journal.

**Graduate E.M.—11 Years experience in various** phases of mine plant development and underground supervision. Desire position in supervisory capacity. Location immaterial. Resume on request. PW-4602, Engineering & Mining Journal.

**Mining Engineer, 37, registered P.E.; 11 years** experience—Underground and Open Pit evaluation, development, operation, design, general construction and operations research. Desires position in Western U.S. or Mexico. Presently employed. Resume on request. PW-4644, Engineering & Mining Journal.

**Professional Mining Engineer, M.S., 30. 5 years** open pit mining; 2 years mine evaluation, taxation, accounting; graduate study in Bus. Adm., I.E., research. Desires challenging position in management or engineering. PW-4669, Engineering & Mining Journal.

**Mining Engineer; Sixty year old "has been"** desires position general superintendency small operation, said applicant has about ten years yet of "has been" experience to offer, will accept moderate salary plus bonus on tonnage produced. N. A. Pratt, P.O. Box 164, Newport, Tenn.

**Armour Industrial Chemical Co.**
has, through promising expansion in the mineral dressing field, two openings for

## MINERAL ENGINEERS

**with interest in Flotation**

Experienced candidates or recent graduates may qualify depending on interest and aptitude.

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To plan, conduct and report on flotation test programs including field evaluations. Minor travel involved.

Sales Development

Opportunity to move into the area of technical promotion liaison, and service. Some travel involved.

Both openings offer the diversity of dealing with problems and new developments relating to a number of different companies and phases of the industry.

Please write full details including salary requirements to:

John W. Church,
Personnel Manager
Armour Industrial Chemical Co.
110 N. Wacker Drive
Chicago 6, Illinois

WANTED

## MINERAL ENGINEER

To design plant, flowsheets & layouts

P3997 Engineering & Mining Journal
68 Post St., San Francisco 4, Calif.

## EXPLOSIVE AND PROPELLANT ENGINEER

Permanent position available in expanding group for development work in the explosive and propellant field. B.S. or higher degree required. Some experience desirable. Please submit complete resume to J. P. Middleton, Technical Employment Supervisor.

**DOW CHEMICAL COMPANY**
Texas Division
Freeport, Texas

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BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

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$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.
PROPOSALS, $1.50 a line an insertion.
BOX NUMBERS count as one line additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

*Send NEW ADS or INQUIRIES to ENGINEERING AND MINING JOURNAL, P. O. Box 12, New York 36, N. Y. for August issue closing July 21st*

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1300 H.P. Vulcan DD, 1570/2500 FPM, 3/60/2200.
700 Allis-Chalmers SD, 1900 FPM, 20,000# Rope Pull, 3/60/2200
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200 H.P. Flory DD, 550 FPM, 3/60/440
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(3) 667 KVA, 66000 Pri., 2300/11500 Sec., West H. 667 KVA, 13200 Pri., 2300/3985Y Sec., West., SL (3)
(3) 500 KVA, 13860 Pri., 240/480 Sec., West., SL.
(3) 500 KVA, 13200 Pri., 2300 Sec., Allis-Chalmers, ODSC.
(3) 400 KVA 15600/13650/12675/7800 Pri., 460 Sec. Wagner.
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300 KW, 250/275 V. DC, MPC-TS, Sy. 80% PF, 2300/4000 AC, Automatic.

**DIESEL LOCOMOTIVES**
(2) 25 Ton, GE Diesel Electric Locomotives, Class B-50-1GE733, 150 H.P., No. 32237-40, Feb. 1955, 42" Gauge.

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2—5 x 8 KVS Air Swept Ball Tube Mills
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Hardinge Mills 3'x8", 3'x24", 6'x48", 10'x48"
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Classifiers: 78"x36'6" Duplex. 84'x42' Spirals 8'x35'x16' Bowl-rake
Crushers, Fine Reduction: 22", 2', 3' — 5½' Cone
3076CFM—Ingor Rand Elec. Compressor
2—150 HP 1-200 HP S.D. Elec., Hoists
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Rotary Dryers: 3'x20', 4'x20', 5'x30', 8'x60', 10'x80'
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**R. C. STANHOPE INC.**
60 E. 42nd St., N.Y. 17, N.Y.

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U. S. Army Telephones EE-8 fully reconditioned. Suitable for intercommunication between 2 or more points. $35.00 for 2 telephones, including 100 ft. of wire and batteries. Additional wire 1¢ per ft. or $25.00 per mile. Writ for free list on telephones. All shipments F.O.B. Simpson, Pa.

**TELEPHONE ENGINEERING CO.**
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**AVAILABLE FOR LEASE—OPEN PIT ZINC MINE**

Located in south central Missouri and comprises 280 acres owned in fee. Includes good mill site, dam, water pond supplied by well and local drainage, ample tailings disposal area, natural timber supply. Mine has been thoroughly drilled and is well opened. Conservative estimate shows large tonnage of sulphide ore averaging 9% zinc metal, available to depth of 65 feet below bottom of present pit 300 feet in diameter. Good ¾ mile gravel road to paved highway, 22 miles to shipping point. Maps and drill records available also smelter returns on substantial tonnage shipped in past. Owners will lease on reasonable terms. Further details on request. Property can be seen by appointment.
**BO 4444 Engineering & Mining Journal, 520 N. Michigan Ave., Chicago 11, Ill.**

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provides
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**Victor 2-8251**

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**FOR SALE**

Patent on pneumatic dynamite loader or will let to mfg. & distributor on royalty basis. Machine has been mine tested and proven. Have blueprints and patterns.

**BO-4728 Engineering & Mining Journal**
**520 N. Michigan Ave., Chicago 11, Ill.**

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**For Sale or Lease**

12 hundred acres improved Bentonite mining claims. High quality jelling Bentonite of the Bell Fauch type, in 6ft. beds; 1 to 6% dip. About 300,000 tons no overburden, 1,000,000 tons available. Reserves undetermined, 6 miles to G.N. Railway siding. For samples and further information write to

**Sam Harvey, Box 415, Harlem, Montana**

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**LABORATORY HYDROCYCLONE TEST SET**

15 and 30mm dia Pyrex Hydrocyclones with accessories in case—Capacity range ¼ to 4 g.p.m. at 2 to 40 p.s.i., with separations down to 5 microns.

**LIQUID-SOLID SEPARATIONS LTD.**
2 Anderson Street, London, S.W. 3, England

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**QUICK SILVER**

**25 TON GOULD TYPE ROTARY FURNACE**
**TOTAL CASH PRICE $7,000.00**

**JOHN F. MORRISON**
2026 Mission St., San Francisco, Calif.

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Charged by 48" belt. Feeds main belt and acts as upper end control station. Impactor type crushers with rolls on eccentrics reduce oversize to about 6"

### NINE CONVEYOR FLIGHTS

Individual flight data provided on request. Motor sizes range from 30 hp to 300 hp. Total horsepower of entire conveyor is 3280 of which 2000 hp is within the regenerative system (5 flights on 25% grade) where power generated is fed back into main system. All flights but one employ gravity type takeups. Troughing idlers are 20°, 3 roll, 5" diameter spaced from 2.75 ft. to 4 ft. apart. Impact idlers are used at transfer points. Band type brakes are used on tail pulley shafts on all but one flight. In addition, thrustor brakes are mounted on the high speed shaft between gear reducer and motor on the 5 flights on the 25% grade.

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**Fans**—Meco 12" compressed air—Coppus TM8DC — Jeffrey Midget DC — Ingersoll Rand, Type FS, 3,150 C.F.M., 1lb./sq. in.
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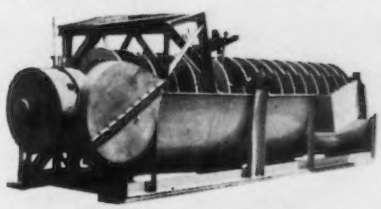

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***Indicates more product information may be found in company advertising appearing in *E&MJ* June 1960 Mining Guidebook and Buying Directory issue. Check your Guidebook Index.**


*Allen-Sherman-Hoff Pump Co. . Second Cover
*Allis-Chalmers . 17, 18-19, 20-21, 22-23, 24, 99
*Alloy Rods Co. ..... 135
*American Biltrite Rubber Co. Boston Woven Hose & Rubber Div. .. 139
American Brake Shoe Co., Railroad Pdts. Div. ..... 118
*American Cyanamid Co. ..... 104-105
*Atlas Copco ..... 137
*Atlas Powder Co. ..... 66-67

*Babcock & Wilcox Co. ..... 10-11
*Bethlehem Steel Co. ..... 34, 119
Booth Co. ..... 132

*Carterpillar Tractor Co. ..... 45, 97, 134
*Chicago Pneumatic Tool Co. ..... 7, 120
*Christensen Diamond Products ..... 12
*Colorado Fuel & Iron Corp. ..... 46
Curtiss Wright Corp., Marquette Div. .. 48

Denver Equipment Co. ..... Third Cover
Detroit Diesel Engine Div., General Motors ..... 60
*Dorr Oliver Corp. ..... 8-9
DuPont, Explosives Dept. ..... 121

*Eimco Corp. ..... 35, 37
*Electric Steel Foundry ..... 115, 116
*Engelhard Industries, Inc. ..... 134
*Euclid Div., General Motors ..... 14
*Exide Industrial Div., Electric Storage Battery Co. ..... 124

*Fairbanks, Morse & Co. ..... 127
*Falk Corp. ..... 61
*Firestone Tire & Rubber Co. ..... 40

*Gardner-Denver Co. ..... 111
*General American Transportation Corp. .. 131
Getman Bros. ..... 138
*Goodrich Industrial Products Co., B. F. . 3
*Goodrich Tire Co., B. F., A Div. of B. F. Goodrich Co. ..... 33
*Goodyear Tire & Rubber Co. ..... 15

*Harbison-Walker Refractories Co. .... 62-63
*Hardinge Co. ..... 130

*Ingersoll-Rand ..... 1
*International Harvester Co. ..... 41, 42-43
*International Nickel Co. ..... 106

*Joy Mfg. Co. ..... 5

*Kaiser Engineers ..... 107
Koehring Co. ..... 58-59

*LeRoi Div. of Westinghouse Air Brake Co. ..... 64
*LeTourneau-Westinghouse Co. ..... 125

*Marion Power Shovel Co. ..... 141
*Mine & Smelter Supply Co. ..... 128-129
Minneapolis-Honeywell ..... 126

*National Malleable & Steel Castings Co. 113
*Naylor Pipe Co. ..... **117**
*New York Engrg. Co. ..... 132
Nichols Engrg. & Research Corp. ..... 101
*Nordberg Mfg. Co. ..... 109
Northwest Engrg. Co. ..... 13

*Porter Co., Inc., H. K. Thermoid Div. ..... 122

*Roebling's Sons John A., Div. Colorado Fuel & Iron Corp. ..... 16

Sanford-Day Iron Works, Inc. ..... 56-57
Searchlight Section ..... 142-147
Sheffield Div., Armco Steel Corp. ..... 133
Smith Engrg. Works ..... 55
Spang & Co. ..... 114
*Sprague & Henwood, Inc. ..... 138
*Sturtevant Mill Co. ..... 140

Tennessee Corp. ..... 132
*Texaco, Inc. ..... 36
Texas Gulf Sulphur Co. ..... 47
Thor Power Tool Co. ..... 103
*Timken Roller Bearing Co. .... Fourth Cover
*Traylor Engrg. & Mfg. Div. of Fuller Co. 44

*United States Rubber Co., Mechanical Goods Div. ..... 95
*United States Steel Corp. ..... 38-39, 123

*Varian Associates ..... 112

Western-Knapp Engrg. Co. ..... 65
*Westinghouse Electric Corp. ..... 68-69
*Wilfley & Sons, A. R. ..... 70

•

PROFESSIONAL SERVICES ..... 142

•

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES ... 143

BUSINESS OPPORTUNITIES ..... 144

EQUIPMENT
(Used or Surplus New)
For Sale ..... 144-147



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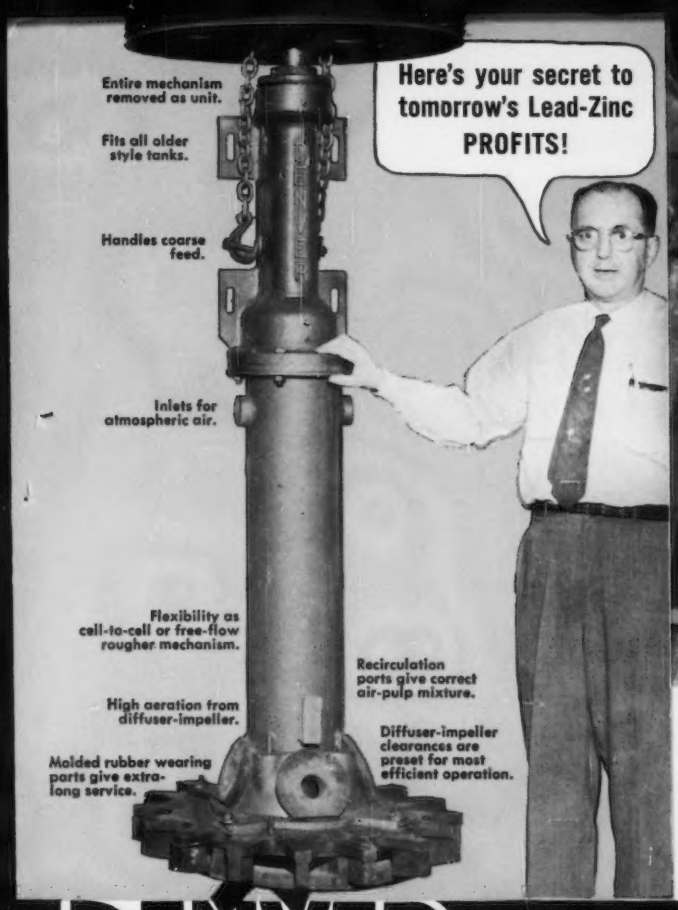
Here's your secret to tomorrow's Lead-Zinc PROFITS!
Entire mechanism removed as unit.
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Flexibility as cell-to-cell or free-flow rougher mechanism.
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Recirculation ports give correct air-pulp mixture.
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| MACHINE SIZE Cell-to-Cell | VOLUME Per Cell (cu. ft.) | MACHINE* CAPACITY tons/24 hrs. | MOTOR RPM | MOTOR HP 2-cell | APPROXIMATE DIMENSIONS Width | Height | LENGTH OF MACHINE 2 Cell | 4 Cell | 6 Cell | Minimum HEAD ROOM Required | SHIP. WT. IN LBS. 2-cell Machine With Motor Domestic | Export |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 Sp. | 24 | 100-200 | 1800 | 5-7½ | 4'-2" | 5'-4" | 6'-2" | 12'-2" | 18'-2" | 8'-10" | 3615 | 4015 |
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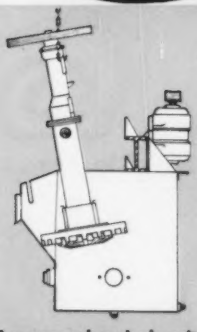
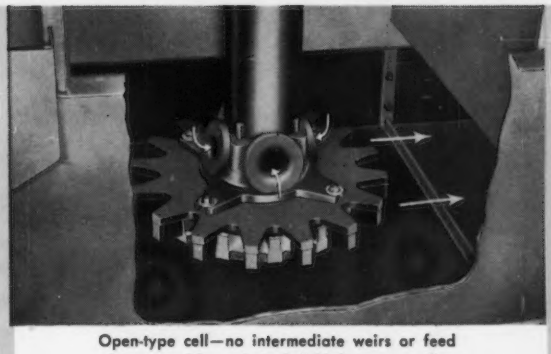
| 30 Sp. | 100 | 800-1000 | 1200 | 20-25 | 6'-2" | 8'-2" | 10'-7" | 20'-11" | 31'-3" | 11'-4" | 14200 | 15600 |

*Number of cells depends upon contact time, density and number of cleaning stages following roughing and scavenging. Capacity approximately only for each size machine. Smaller size Denver cells are also available for small tonnage and pilot plant service.

# DENVER Sub-"A" FLOTATION



• Mechanism removed as single unit. Permits rapid inspection or replacement of wearing parts without stopping flow to cells, or shutting down entire plant.



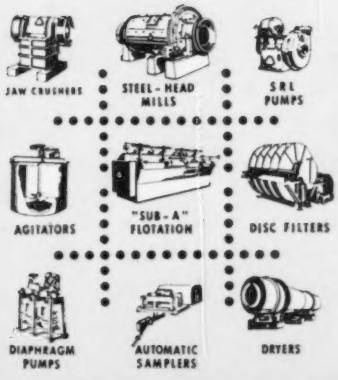
Open-type cell—no intermediate weirs or feed pipes—provides unimpeded high tonnage flow of pulp. New simplicity, high rougher flotation efficiency, low cost in flotation rougher circuits.

## Lead-Zinc Mill Operators $ave with DENVER "Sub-A" Flotation on...

| | |
|---|---|
| Initial Cost | Installation |
| Horsepower | Operation |
| Wearing Parts | High Grade |
| Low Final Tailings | Concentrates |

Now, do entire flotation job—roughing, cleaning, recleaning, scavenging—*with one machine*. No pumps; all cells are on same level. Save on parts inventory.

***PHONE OR WRITE TODAY.*** Describe your operation. Our engineers will help you improve your rougher-cleaner flotation results. Complete testing facilities available.

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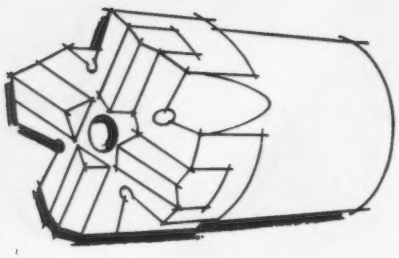
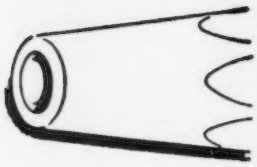
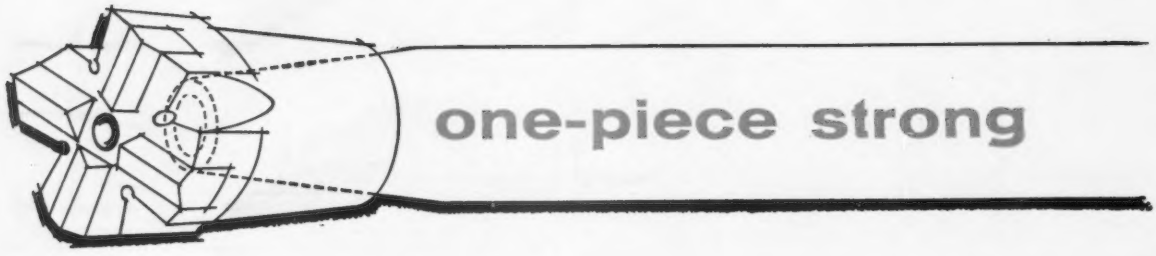


Removable



**yet**



one-piece strong

# That's why the Timken® air-leg bit cuts your drilling costs these 4 ways

1. You don't have to throw away good drill steels when the carbides wear out, the way you do with intrasets. The Timken bit is removable!

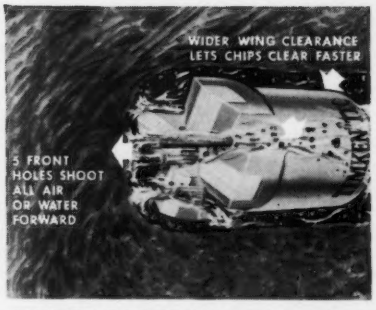
2. You don't have to haul an armful of steel to the mine the way you do with intrasets. A pocketful of Timken removable bits is enough for a whole day's work.

3. You can change bit gauge sizes fast on the same steel with a Timken bit for air-legs. Using intrasets you have to change the whole steel.

4. You carry only the bit to the shop for resharpening—when it's a Timken removable bit. With intrasets you "fight" the whole steel and Timken bits give longer gauge wear because there are *four* carbide cutting edges. Most intrasets have only two.

Get all these savings in an air-leg bit that's *tapered* for one-piece strength. And get faster chip clearance, too (see diagram at right).

Specify the Timken tapered socket carbide insert bit for air-leg drills. For free brochure write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*




**CHIPS CLEAR FASTER** because 1) five front holes shoot water or air directly against the rock face and 2) deeper, wider wing clearance lets chips wash back faster.

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